APPLIED HYDRAULICS

SEPTEMBER 1954

THE MAGAZINE OF
FLUID POWER

INCLUDING AIR CONTROLS AND AIR CIRCUIT DESIGN • ELECTRICAL CONTROLS

THIS MONTH:

Synchronization with Two Pump System . . . page 60

Noise in Vane and Piston Pumps . . . page 66

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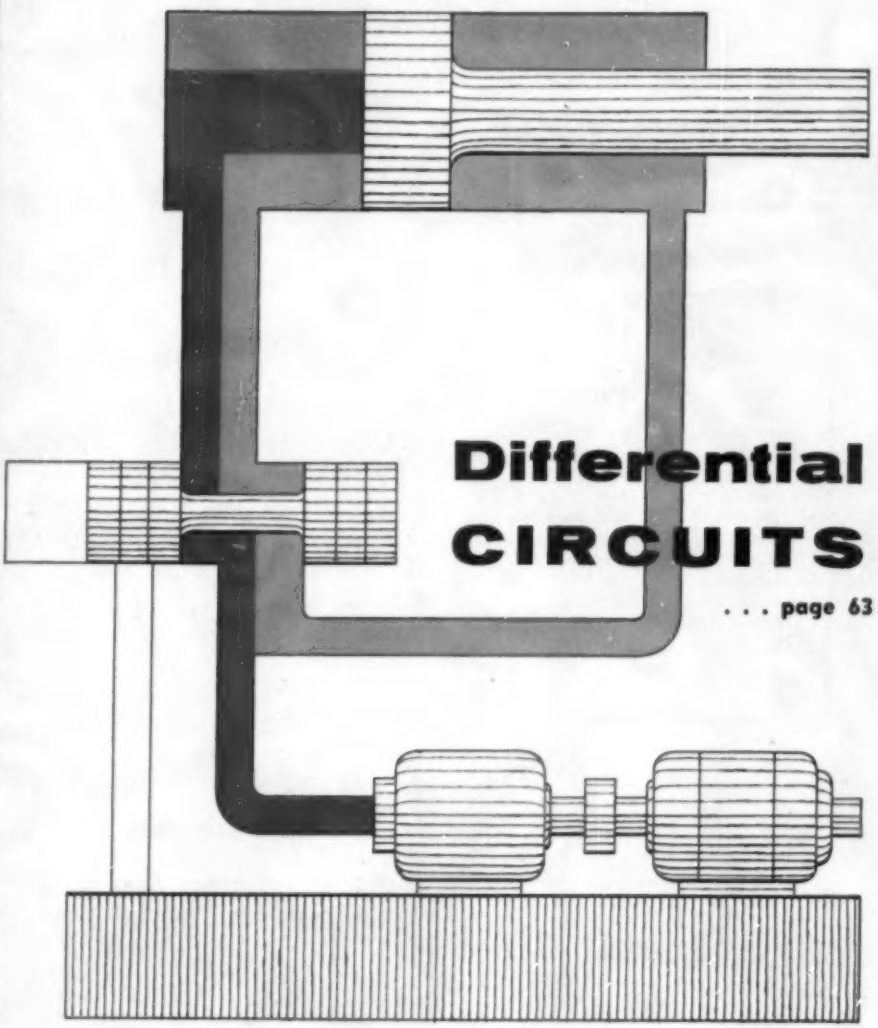
FRANCHISE CIRCULATION



Differential CIRCUITS

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SEPTEMBER, 1954
Vol. 7, No. 9

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All communications should be addressed to APPLIED HYDRAULICS, 1240 Ontario St., Cleveland 13, Ohio. Phone SUperior 1-9622.

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APPLIED HYDRAULICS

PNEUMATICS - HYDRAULICS - ELECTRICAL CONTROLS

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Published monthly, by THE INDUSTRIAL PUBLISHING GROUP (Division of Telenews Productions Inc.), publishers of COMMERCIAL REFRIGERATION & AIR CONDITIONING, PRECISION METAL MOLDING, FLOW, INDUSTRY & WELDING, and OCCUPATIONAL HAZARDS. Member, Business Publications Audit of Circulation, Inc.

Subscription rates: United States and possessions—$3.00 per year, $5.00 for 2 years; Canada—$4.00 per year, $6.00 for 2 years; Foreign—$5.00 per year, except the United Kingdom. United Kingdom subscriptions £1.10 per year, payable in Sterling to our London Office. Single copy price, 30 cents. All subscriptions subject to individual acceptance by the publisher.

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APPLIED HYDRAULICS

Fluid Power Lines

Quick Pay-off

We hear a lot these days about how certain tooling on a production line has paid for itself in an unbelievably short time. Such quick "pay-offs" aren't unique with mass production metal working tools. This month's lead article tells how built-in jacks which are used only twice a year pay for themselves the first time they are used. The jacks are used to open the tapered joint when servicing is required on a large ore crusher which handles 3500 tons every hour. Design of these jacks presented several interesting problems involving seals and selection of a power source. George D. Becker tells how these problems were solved.

Feed Circuits

Ed Gatwood of Vickers compares cam and solenoid operated feed circuits in this issue. Three different methods for changing from rapid advance to feed are described. Widely used on machine tools, these circuits provide reliable control for moving tool or work slides.

Don't Twist the Work!

In Art Lassman's article, the work is a railroad car carying slag which is dumped by two hydraulic cylinders. If the cylinders don't move together, the car will twist. Before that happens something is going to give. Getting the cylinders to move together is just one of the design considerations on this job. Elimination of shock and design of an oscillating cylinder were also accomplished. Although you may not have any railroad cars to dump, you'll be able to use some of the ideas from this article on any job where two cylinders must move a heavy load.

10th NCIH Meeting

It is a good idea to register now for the 10th annual National Conference on Industrial Hydraulics. On page 59 you'll find a convenient registration form along with information about this important October meeting. In the October issue, APPLIED HYDRAULICS will publish the complete program for the two day meeting along with abstracts of the papers which will be presented.

Winners of the 1954 APPLIED HYDRAULICS Prize Paper Contest will be announced in the October issue. The three top papers will be published and the $500, $300 and $200 prizes will be presented at a luncheon meeting of the National Conference on Industrial Hydraulics.

Basic Hydraulics

Our mail has always shown that APPLIED HYDRAULICS readers have a strong interest in articles about basic hydraulic designs. We believe this interest will always be maintained because new people are continually becoming responsible for the design, maintenance and operation of fluid powered equipment. In all articles, we try to cover every aspect of a particular design; however, space does not always permit complete basic treatment of any one phase. Recently, we've had requests for material on the operation of the differential or regenerative hydraulic circuit. These circuits are widely used and have been shown in many of our articles. To provide a complete analysis of differential circuits, Jim Tankard, who does much of the hydraulic design work at Zagar Tool Inc., has prepared the article on page 63.

Does Noise Mean Trouble?

On an oil powered machine, it usually does. It may not mean impending failure but it sure does mean reduced life of pumps and valves. At the very least, noise is annoying to the machine operator. This month, the second part of a two part article by E. L. Midgette appears on page 66. Last month, elimination of noise in gear pumps was discussed. How to reduce noise by proper design of vane and piston pumps is the subject of part 2.

Did You Catch the Error?

With our product, which you're holding in your hand, no amount of welding on or filing off will help correct an error. Since we're terribly sensitive, one error is enough to make us feel badly. It ups our spirits considerably to get letters from readers who have noted and corrected a mistake. It's comforting to know that the error does not go unquestioned.

On page 57 in July, we lost an oblique line which makes the difference between a normally closed or normally open contact. This mishap is just enough to keep the circuit from operating. Readers sent us an extra supply of oblique lines which we hope will keep us alert.

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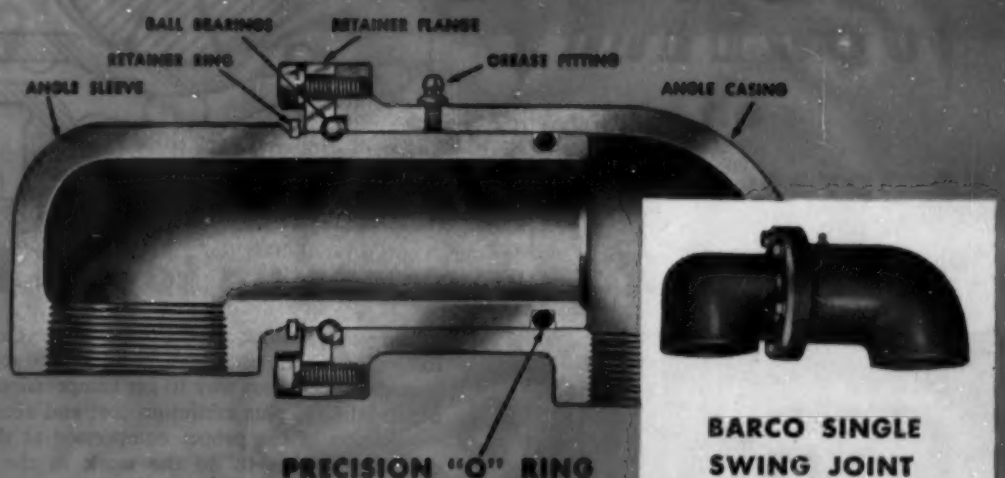

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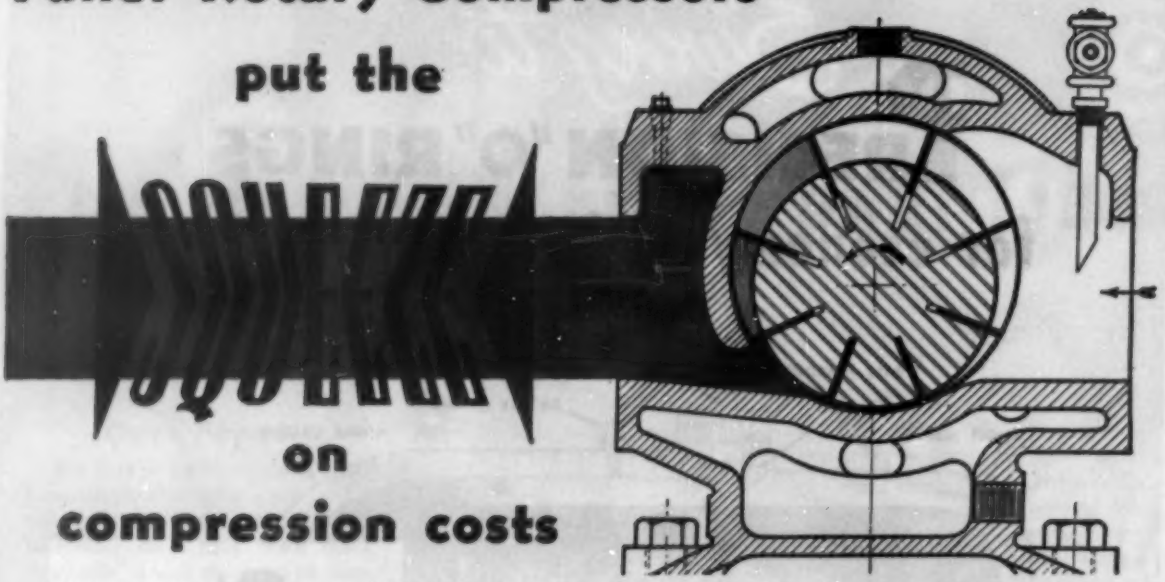

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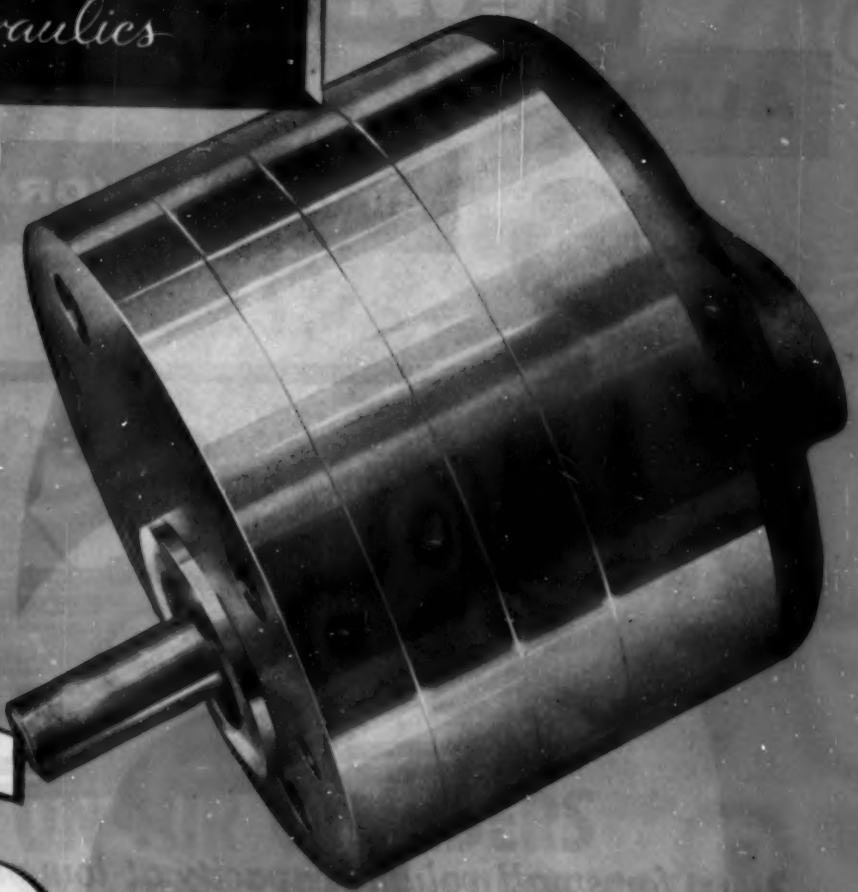

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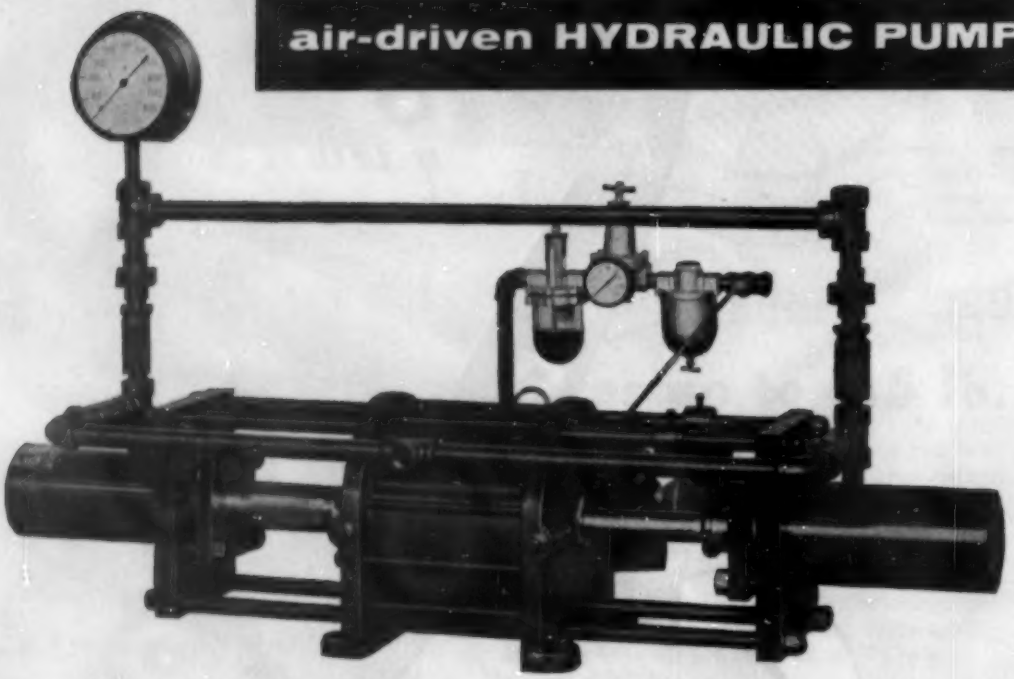

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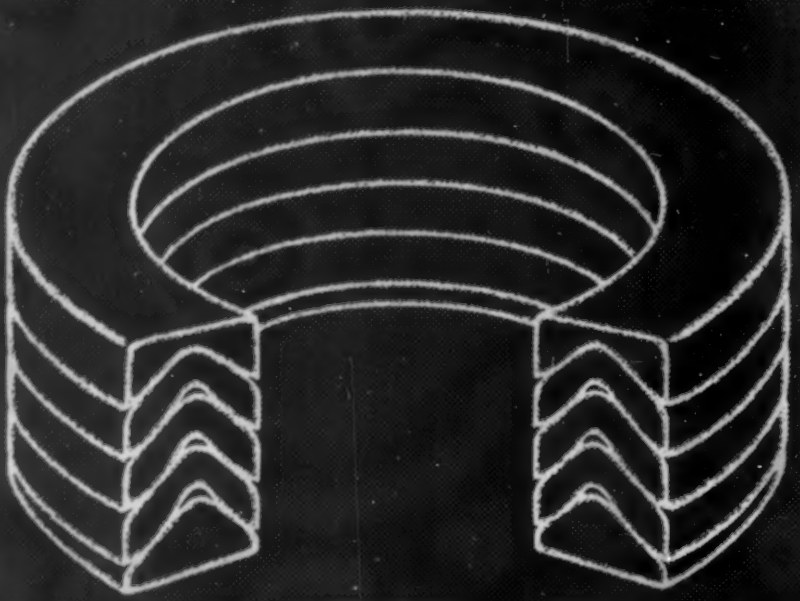

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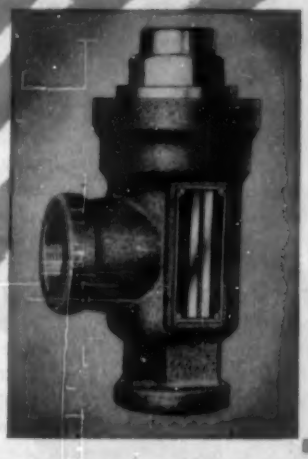

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Circle 151 on Reader Service Card

ELECTRIC TIMING DEVICES . . . are described in catalogs and engineering bulletins made available by Haydon Manufacturing Co., Inc., Catalog No. 322 describes several series of timing motors which are suitable for any application. Catalog No. 323 outlines the timing devices available, including time delay relays, reset timers, interval timers, elapsed time indicators, fixed interval repeat cycle timer and direct current timers. Catalog No. 324 covers the clock movements available. All company products are powered by the same synchronous motor. The basic motor speed is very slow and the motor is completely enclosed for protection against dust and dirt. Bulletins

Circle 152 on Reader Service Card

PNEUMATIC REGULATORS, RELAYS, FILTERS . . . The story of these units, dealing with all phases of construction, performance characteristics, capacities and features, is told in a 12 page bulletin No. H-1, released by Conoflow Corp. The regulator is designed primarily for manual loading and small flow service. It is a precision reducing-relief valve with a high degree of sensitivity. Is sensitive to adjustments within tenths of an inch of water. Displays same characteristics at low pressures (1-2 psi) as at higher pressure (30-50 psi). The ratio is a device for varying the output pressure of a controller in a predetermined ratio, either direct or reverse, with an input pressure. The vacuum regulator will hold a vacuum in the range of 30 in absolute to 1 in absolute. The filter medium of the standard unit has an area of approximately 5 sq in sufficient for the average pneumatic controller. Other units are included. Many diagrams are used to illustrate construction, dimensions and systems.

Circle 153 on Reader Service Card

DIRECTIONAL AND FUNCTIONAL VALVES . . . for oil hydraulic service of 3000 psi are completely described in catalog No. 841, made available by Hydraulic Power Division. The Hydraulic Press Mfg. Co. Many 4-way valves are illustrated and described including cam operated, single solenoid, integral pilot, double solenoid, pilot operated, air pilot operated, 2-way valves, cam operated, single solenoid and pilot operated, rotary pilot valves, relief, sequence and pressure reducing valves. Many more types are included. All are well illustrated. Installation dimensions are given for the sizes listed. A section of the catalog is devoted to subplates, both with straight and side outlets.

Circle 154 on Reader Service Card

AUTOMATIC CONTROLS . . . A folder on automatic controls that can be adapted to manually controlled hydraulic compression presses, batch process machinery or where cyclical operation is required, is available from the Seely Instrument Co., Inc. It describes the applications for timers, temperature and pressure controls and air diaphragm motor valves, that can be arranged singly or in any combination to offer semi or fully automatic operation of present machinery. This folder will prove of value to those interested in tire and tube molding, molding of plastics, phonograph record pressing, metal extrusion and similar industries.

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POWER JACKS . . . The majority of machining, grinding, welding, riveting, drilling and many other operations on irregular shaped pieces, necessitates some sort of a fixture to support the piece in the desired position. A bulletin, released by Power Jacks, Ltd. describes a clamping device which provides a simple means of holding work. The system comprises a hand operating hydraulic pump of the lever or screw type and one or more hydraulically operated plungers, which may bear directly on the work piece or act through a system of levers or bell cranks. The clamps are released simultaneously and fluid returns to the pump container retracting the plungers.

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For more reviews of Free Literature turn to page 124

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how *Hydraulic power* delivered through

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HYDRAULIC HOSE ASSEMBLIES

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Massey-Harris, shipping agricultural tractors and implements to 106 countries the world over, has developed some of the most ingenious hydraulic controls to meet the needs of modern contour farming — controls which not only do most of the hard work—*but do it automatically!*

EASTMAN Hydraulic Hose Assemblies carry oil at 1000 psi from the Massey-Harris 2-Way, 2-Speed *"Depth-O-Matic"* Hydraulic Control to raise and lower tractor mounted implements smoothly, easily, swiftly. Synchronized slave cylinders handle harrows, discs, plows.

Massey-Harris *"Selective Control"* maintains uniform cultivator penetration on hillside contour slopes, pictured above, through independent action of right and left gangs. *"Delayed Action"* permits raising front and rear gangs independently at contour points, also permits shovels to leave and enter soil at same point at ends of rows.

Other users of EASTMAN Hydraulic Hose Assemblies in the agricultural field include: Allis-Chalmers Mfg. Co.; J. I Case; John Deere Co.; The Farmhand Co.; Harry Ferguson, Inc.; Horn Manufacturing Co.; International Harvester Co.; Minneapolis-Moline Co.; Ottawa Steel Products Co.; Super-Six Manufacturing Co.; A. F. Wagner Iron Works.

Look to EASTMAN—first in the field—for continued leadership in "Safeguarding the Lifelines of Mobile Power"—in Industry and Agriculture!

Specify

Eastman

first in the field

HYDRAULIC HOSE ASSEMBLIES

for the best performance, for long life and satisfaction—*all along the line*—from manufacturer to user. Check your needs on the following list:

COUPLINGS

Solid Male

Swivel Male

Swivel Female

STRAIGHT AND ANGLED ADAPTER UNIONS

Straight Male

90° Male

45° Male

Write

for free catalog 103 on Eastman Hose Couplings and Bulletins 2318 & 2328 on Straight and Angled Adapter Unions.

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GROWING HORIZONS FOR FLUID POWER

NEWS • ACTIVITIES • PLANS

What Do Your Drawings Cost?

More and more drafting rooms are getting away from the old hard and fast rules of mechanical drawing. Management now realizes that artistically executed drawings with numerous projection views and sections are not necessary. Accurate, clear drawings can be made while eliminating a great amount of costly details. New rules for mechanical drawing are based more on common sense than tradition. The education and supervision required to adopt simplified drafting methods will pay off in dollars equal to the best cost cutting procedure on a production line.

Producing "Short Runs" Automatically

Automatic screw machines have been economically producing parts for many years. Since part cost is greatly influenced by the quantity of the run, the cost of automatic tooling for making 5, 10 or 25 pieces becomes prohibitive. Design of tape controlled machines to solve this short run production problem, as well as high production runs, has been going on for almost 150 years. Punched cards were used to control a loom in 1804. Like cams or templates, economical preparation of the tape for short runs has been the problem. Today the possibilities of using modern computing machines to prepare the tape offer a solution. Development work being carried on today should result in production lathes and milling machines having hydraulically powered slides which move in response to a signal from a punched tape.

No Ups and Downs in Machine Tools

A chance to stabilize the machine tool industry is seen by Herbert L. Tigges, president, National Machine Tool Builders Association and executive vice president of Baker Brothers Inc. He feels that a combination of factors exist today which will help machine builders level out the historically rugged machine tool cycle. They are: Continuing high level of industrial production throughout the country, great obsolescence in the nation's equipment, intensified cost-consciousness among machine tool buyers, continuous national defense requirements and a more understanding government attitude.

Hydraulics for Powdered Metal Parts

Press manufacturers are giving more attention to the development of oil powered presses for powdered metal parts. Where deep fills are required the use of a hydraulically powered ram has a great advantage. Ram speed can be readily regulated to a slow motion which gives trapped air more time to escape and thus reduce flaws in deeper fill parts.

Wanted: More Package Units

At this year's Machine Tool Electrification forum of the Westinghouse Electric Corporation, a panel discussion devoted to machine tools in the automotive industry gave its recommendations on the nature of control equipment. They want package units to handle the loading, positioning, gauging and unloading of parts. This presents a challenge to the special machine builder who can combine electrically controlled hydraulically and pneumatically powered devices into a production package.

High Pressure, High Temperature Piping

The Radiation Effects Branch of the Naval Research Laboratory has developed a joint for assembling high pressure, high temperature piping without gaskets. A large number of joints in stainless steel pipes from 3/4 to 3 inch diameter of this type have been hydrostatically tested at room temperature to 4000 psi without failure or leakage. Both temperature cycles and continuous operation tests at 600 degrees F were satisfactory. Although designed for stainless steel, it is believed the principle is capable of extension to other materials.

Diversatility rides again

in the new COMPLETE line of SPEED KING

Valvair Solenoid Pilot Operated Control Valves

Valvair Speed Kings are small, light in weight, with a speed of 600 cycles per minute, and proven capable of 20,000,000 cycles and up.

The New Valvair Speed King line is complete — 3-way, 4-way, and 4-way-5-port (2-pressure), foot-mounted or sub-base manifold mounted; pipe sizes — ¼", ⅜", ½", ¾", 1". COMPLETE — to fit almost innumerable applications. A precedent-breaker in size, weight, speed and endurance. Only two moving parts. Non-corrosive materials throughout. Solenoid and pilot valve parts are totally enclosed, but easily accessible. *Get all the facts!*

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Ask for Bulletin "AH-9"

One flow control does the work of nine

Denison Multi-Range Flow Control Infinitely adjustable for any delivery without changing spools

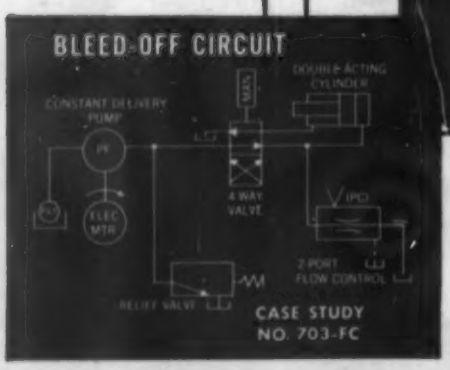
One dial now controls flow for as many as nine different ranges . . . assures accurate rate of flow . . . often eliminates need for a variable-volume pump.

With Denison Multi-Range Flow Control, there's no need to change valves or spools. If pump delivery is changed, simply turn the dial.

Available in ¼, ⅜ and ¾-inch port sizes. For any circuit to 3000 psi. Capacities to 28 gpm.

Subplate-mounted, Denison Multi-Range Flow Controls come in 2-port and 3-port types . . . with or without built-in check valves. The 3-port type meters flow to the work and diverts excess to tank.

The bleed-off circuit shows a Denison Flow Control regulating cylinder speed. For bulletins about Denison Multi-Range Flow Controls, write to: THE DENISON ENGINEERING COMPANY, 1166 Dublin Road, Columbus 16, Ohio.



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The price advantage formerly enjoyed by injection molded "O" Rings no longer exists! LINEAR, with an exclusive, new and revolutionary process, now brings you ROTO-MOLDED "O" Rings—true compression-molded quality, at prices competitive with ordinary rings!

LINEAR'S new ROTO-MOLDING process is an entirely new method of compression molding that eliminates flash . . . produces a tough homogeneous grain structure far superior to injection or transfer methods. There's no danger of "accordion joints" or partial knitting. Every LINEAR ROTO-MOLDED "O" Ring is uniformly perfect—built for complete dependability in your product.

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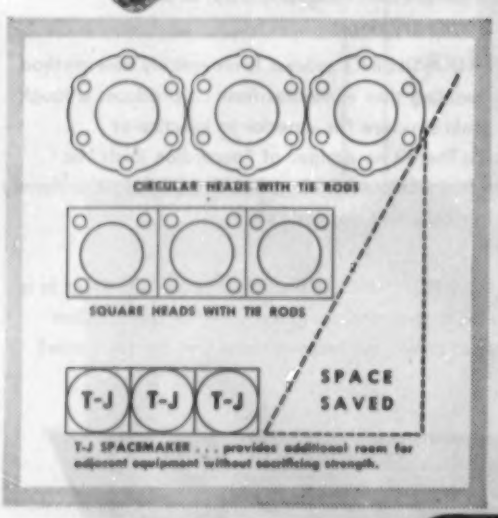
WITH EXTRA HIGH
SAFETY FACTOR!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New "Self-Aligning" adjustable oil cushion means faster acceleration and better cushion than ever before . . . New T-J Super Cushion Flexible Seals for air insure positive cushion with automatic valve action for fast return stroke.

More plus features include—heavy wall, precision honed, hard chrome plated, seamless steel body . . . leakproof cylinder head to body construction . . . heavy duty, high-tensile, *hard chrome plated piston rod.* Write for bulletin SM-454-2. The Tomkins-Johnson Co., Jackson, Mich.

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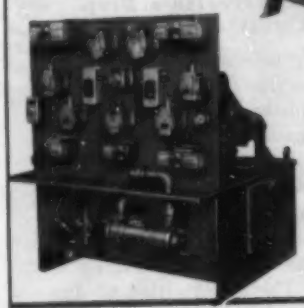
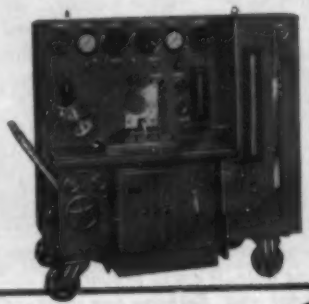
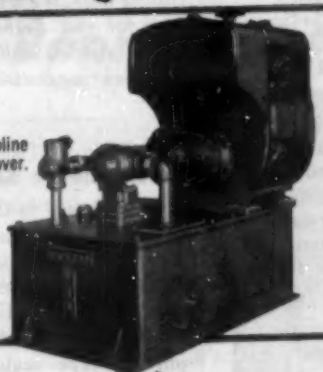


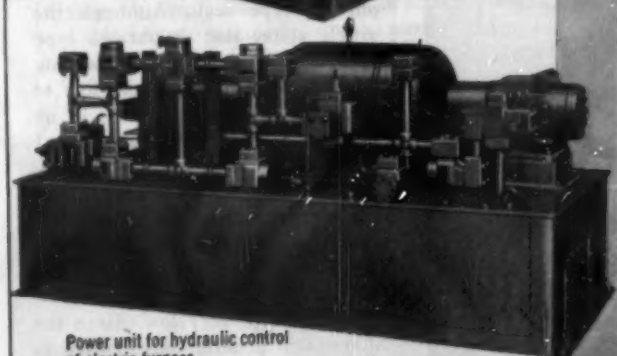
Compact power unit showing gasket-mounted valves.



Portable power unit for testing pumps.

Power unit with gasoline engine as prime mover.





Power unit for hydraulic control of electric furnace.

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BETTER APPEARANCE

Vickers engineers approach the design of a custom-built hydraulic power unit from the standpoint of the customer's INDIVIDUAL needs. The sole objective is to meet HIS requirements with the best hydraulic "package". This assures the most compact, efficient and convenient hydraulic equipment for the particular machine.

A Vickers Hydraulic Power Unit includes all necessary pumps, valves, intermediate piping, oil reservoir, motors, controls, etc., as well as all hydraulic accessories (oil filters, air cleaners, oil level gauges, fittings, etc.). Hydraulic connections can be grouped in a convenient manifold.

In addition to the advantages mentioned above, each Unit is pretested at the factory and ready for immediate operation. Vickers undivided responsibility for the entire hydraulic control system is also an important feature to both the machine builder and his customer. Write for Bulletin 52-43.

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Because Teflon is chemically inert—it requires no chemical inspection, is unaffected by all hydrocarbons and newer synthetic hydraulic fluids. Its service temperature range is from—110° F to +500° F. It has unsurpassed anti-friction properties, is extremely resilient, tough, long wearing. It is waterproof, non-flammable. It requires no water-soak for installation..

CHEM-O-GREEN BACK-UP RINGS are an outstanding example of TEFLON'S superiority. Made in solid, split or the spiral type, preferred by engineers, they solve the "O" Ring extrusion problem. A companion product to Chemiseal synthetic rubber "O" Rings, they are sold as a "Packing package" for all commercial and AN requirements. Write for Catalog OB-1152.

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LETTERS to the Editor

Flow and Pressure Drop Across a Piston

We are presently trying to calculate the flow and pressure drop across a piston in an assembly similar to commercial cylinders. The pressure drop and flow will be dependent on factors of piston length and clearance between piston and cylinder wall, since the piston will not contain cups or packaging of any sort. The investigation to date has not produced any available literature to help with a logical solution. It is hoped your facilities might yield a source of information that would aid in gaining some answer to this problem.

ROBERT G. MICHEL,
Assistant Engineer,
Nuclear Power Section,
Allis-Chalmers Mfg. Co.

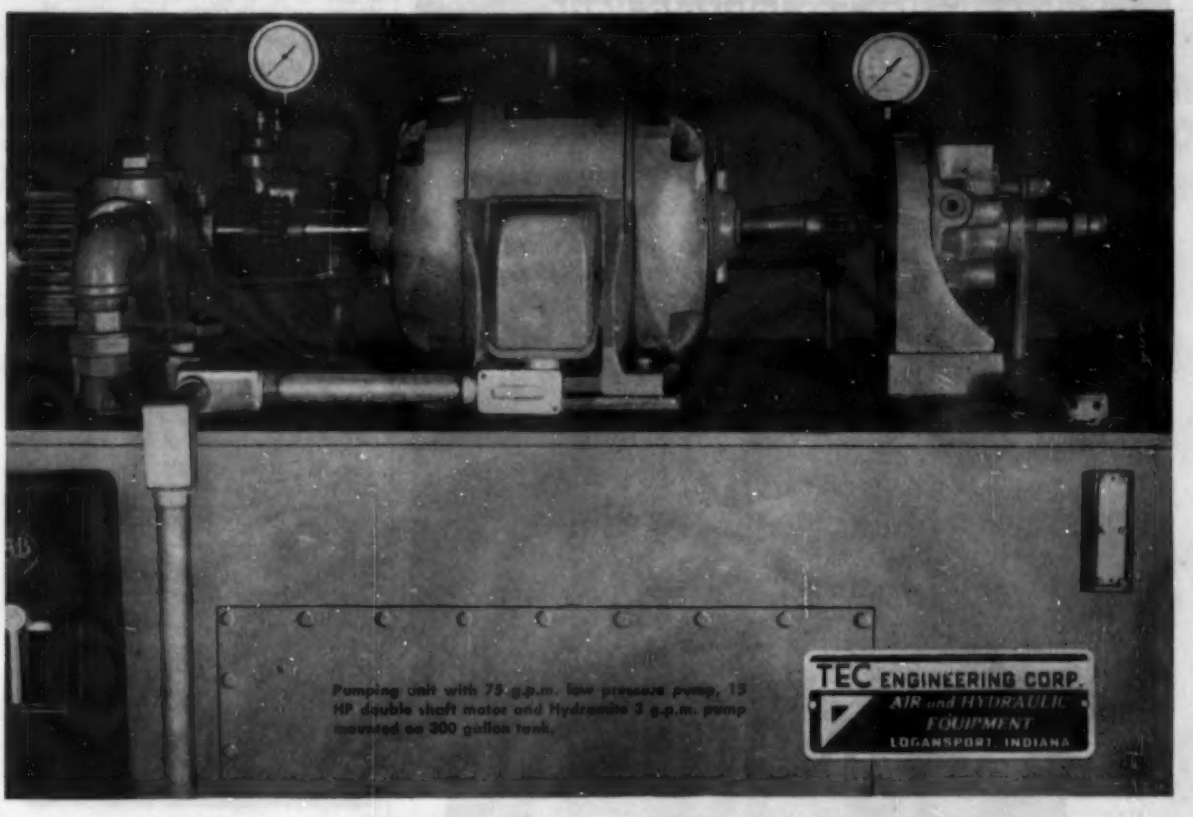
Your letter came just before our closing date. We will prepare an answer for you. Perhaps one or more of our readers will also be able to give you suggestions.

Article on Shaft Seals

With regard to the very informative article, "Mechanical Seals for Hydraulic Equipment" by Messrs. Stevens and Greiner in the June issue of APPLIED HYDRAULICS, I wish to offer a correction on diaphragm type seals. Although the article states that diaphragm type seals are not adapted to balancing or high pressure, it is possible to overcome both these drawbacks by proper design. Some years ago, I developed and patented a diaphragm seal for the Chandler-Evans fuel pump which was capable of over balancing or under balancing, and also could withstand fairly high pressures since the unsupported area was kept very low. Since the diaphragm material was allowed to deflect under pressure against a

Continued on page 22

WHEN IT'S HIGH PRESSURE, IT'S **AMERICAN!**


Pumping unit with 75 g.p.m. low pressure pump, 15 HP double shaft motor and Hydramite 3 g.p.m. pump mounted on 300 gallon tank.
TEC ENGINEERING CORP.
AIR and HYDRAULIC EQUIPMENT
LOGANSPORT, INDIANA

AE Representative gives draw press a "one-two" punch

FOR TOP EFFICIENCY, a kitchen cabinet manufacturer needed high speed in a draw press for positioning material plus high pressure for the actual draw. The local AE Representative, Tec Engineering Corp., of Logansport, Indiana, solved the problem with a single power unit consisting of a 75 g.p.m. low-pressure gear pump to move the material into place and a 3 g.p.m. Hydramite to supply 3500 p.s.i. for the actual draw.

Hydramite pumps operate on most of the makes and viscosities of oil suitable for hydraulic circuits and always operate with efficiency and economy ... through a wide range of sizes ... with pressures up to 5000 p.s.i.

Whatever your hydraulic pumping problem, there's an American Engineering Representative in most areas to save you time and money on both engineering and construction. And you have *local* responsibility for continuous efficient service.

Mail coupon for full information about Hydramite for constant displacement from 3 to 100 g.p.m.; or about the Hele-Shaw for variable displacement from 1 to 110 g.p.m. and pressures to 3000 p.s.i.

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Gentlemen: Please send me complete information about the ☐ Hydramite. ☐ Hele-Shaw.

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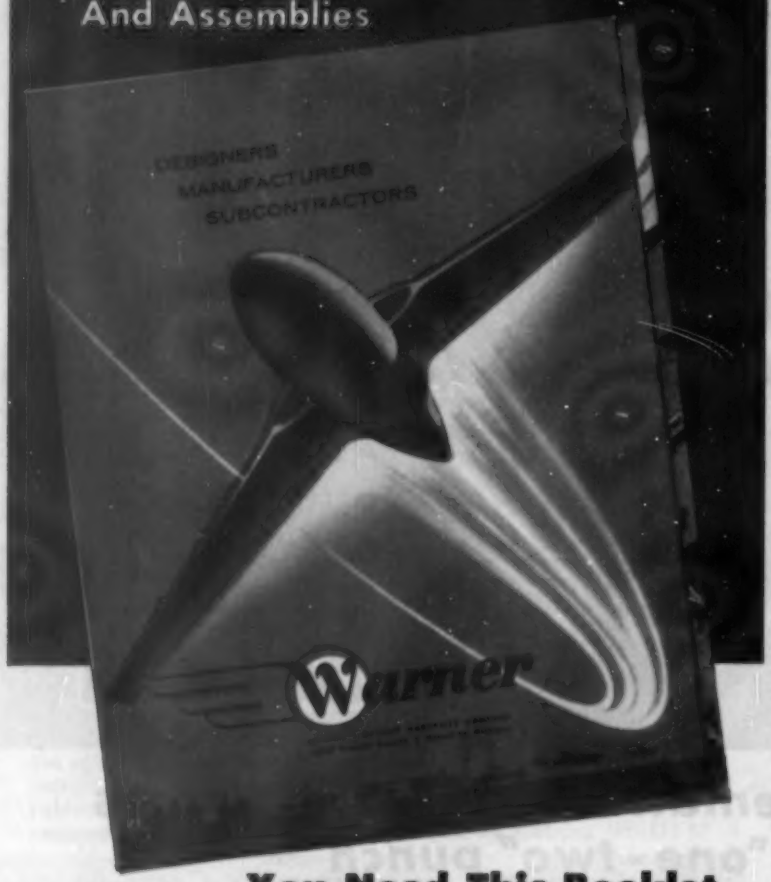
If You Are Looking For A Precision Subcontractor For Intricate Parts And Assemblies



. . . You Need This Booklet

The Warner Division of Detroit Harvester Co. has moved into a new and larger manufacturing plant. This expansion places Warner in a position to take an additional precision subcontracting work for aircraft and ordnance plants.

Capitalize on Warner's ability to manufacture to exacting tolerances. Consider Warner for the production of—

Landing Gear Cylinders, Pumps, and Valves
Hydraulic and Pneumatic Assemblies
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Send today for your copy of the illustrated booklet shown above describing Warner's complete facilities. Warner engineers will welcome the opportunity to discuss your requirements with you.

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2422 Forest Park Blvd., Fort Worth, Texas
7227 West 90th St., Los Angeles 45, California

Letters to the Editor

Continued

strong support plate, high strength was obtained without a loss of flexibility. Collar thrust was taken by a universal washer. This seal is in production.

E. LAAS,
Project Engineer,
The Lee Company

Thank you, Mr. Laas, for your letter. We are glad to call this to the attention of our readers.

Trimming Flash From Small Rings

We have a problem of trimming flash from very small sizes of "O" rings, e.g., ¼ inch OD, and we have been wondering what methods are being used in your country to do this operation. We have certain information that American manufacturers possibly deep-freeze and then tumble rather than endeavor to trim by hand, which, of course, is very laborious and uneconomical on such small sizes. There may be some other methods for doing this job economically. If you can assist us we shall be grateful. Is there any Association we could approach who would guide us in this connection?

H. CLAYTON-WRIGHT
Howard Clayton-Wright Ltd.
Wellesbourne, England

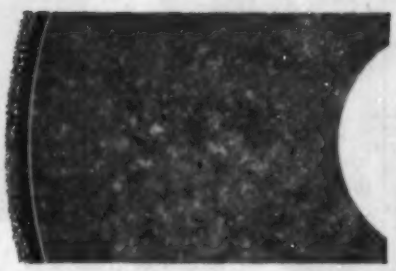
A check with several manufacturers of "O" rings as well as our own observation on plant visitations adds up to the fact that by far the most common method of removing flash from small size "O" rings is by quick-freeze or deep-freeze, followed by tumbling. For larger sizes the tumbling is done in either sand or shot. The decision as to whether one method would be used instead of another depends upon the individual manufacturer, the compound used in thet ring and the finished specification of the customer. Until recently, there has been no trade association in the hydraulic and pneumatic equipment and associated accessory and materials field in this country. However, the National Fluid Power Association, a trade association of manufacturers in this field was formed a little over a year ago.

Continued on page 24

GRADUATED DENSITY

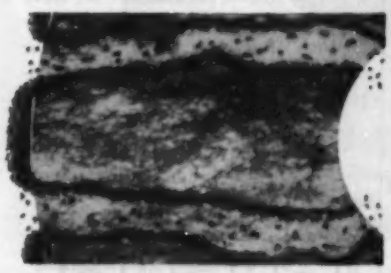
makes MICRO-KLEAN the most effective filter on the market!

How MICRO-KLEAN compares with other cartridge filters



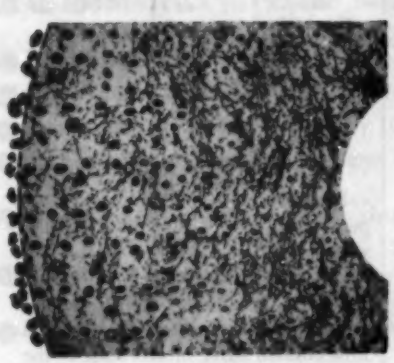
***Compare* MICRO-KLEAN with**

FILTERS WITH THE SAME DENSITY THROUGHOUT. The filter media density is the same on the pressure and discharge surfaces of the element; therefore, dirt accumulation is largely on the outside surface, choking the cartridge ("plastering") and reducing the effective filter life.



***Compare* MICRO-KLEAN with**

FILTERS WITH HAPHAZARD DISTRIBUTION OF FILTER MEDIA. Uneven haphazard media density permits fluid to find channels through the filter, and pass solids larger than the minimum filter spacing.



***Now Look* at the advantages offered by MICRO-KLEAN.** See how the fibre density increases toward the discharge side of the MICRO-KLEAN filter cartridge? In effect, every Cuno MICRO-KLEAN cartridge is an infinite multiplicity of screens, ranging from relatively coarse on the outside down to 10 microns in the center. Because of MICRO-KLEAN's graduated density in depth, particles are entrapped within the entire depth of the filter element, giving the cartridge a much longer effective life. Standard cartridge size is 9¾" long by 2¾" O. D., in densities of 10, 25 and 50 microns.

MICRO-KLEAN gives you

- **greater dirt holding capacity**
- **absolute protection against rupturing or channeling of the cartridge**
- **longer effective cartridge life**

REMEMBER . . . IF YOU CAN PUMP IT, CUNO CAN FILTER IT

M.3.C

CUNO ENGINEERED FILTRATION

Recovers More Steel of Sulfide Forms Micro Kinds of Particles

AUTO-KLEAN (disc-type) • MICRO-KLEAN (fibre cartridge) • FLO-KLEAN (wire-wound)

COMPACT, FULL-FLOW FILTRATION FOR HYDRAULIC SYSTEMS

Fewer cartridge changes necessary with MICRO-KLEAN filters

You don't need a complicated, bulky filter to keep contaminants out of your hydraulic fluids. Cuno MICRO-KLEAN's compact construction gives you full-flow filtration in space which would limit ordinary filters to by-pass service.

The high porosity and low pressure drop operation of MICRO-KLEAN filters permit this full-flow service on gravity, low pressure, or suction lines—with no loss in operating efficiency.

Cartridge replacement costs are generally cut in half, when MICRO-KLEANS are used. MICRO-KLEAN's graduated density-in-depth allows greater capacity for dirt accumulation within the micronic cartridge, giving twice the useful life of an ordinary filter element.

Cuno's exclusive method of felting fibres produces a cartridge of great structural strength, free from channeling or distortion and entirely unaffected by moisture or acids. The specially engineered construction of MICRO-KLEAN affords simplicity of installation and maintenance. Cartridges can be changed in a few seconds—only one nut has to be removed.

Send for Cuno's free filtration analysis form, have one of your engineers fill it out, and mail it to us. We'll let you know exactly what you need to take care of your filtration requirements efficiently and economically—without obligation. And take advantage of Cuno's unique "money-back" offer: if MICRO-KLEAN doesn't outperform any filter cartridge you have previously used, we'll send you *double* your money back. Send the coupon today for free MICRO-KLEAN bulletin. M.3.6

Cuno Engineering Corporation
Dept. 356C South Vine Street, Meriden, Conn.

I'm interested in your "money-back" offer. Please send me your filtration analysis form—and more information on MICRO-KLEAN.

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Company.....

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• IN PERFORMANCE
• IN LONG USEFUL LIFE

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TP-5000 SERIES

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TRIPLEX PUMPS

• HIGH PRESSURE
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• SOLID CERAMIC PLUNGERS
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• STREAMLINED DISCHARGE
• SELF-ADJUSTING PACKING

Covering the range from 5 to 258 gallons per minute at pressures to 5000 p.s.i., these continuous-duty AJAX Pumps provide completely dependable performance at low investment cost.

Write for the notable engineering and construction features of Ajax TP-4000 and TP-5000 Series Triplex Pumps—the reasons-why of finer service on scores of industrial hydraulic power applications!

AJAX IRON WORKS
CORRY, PENNSYLVANIA

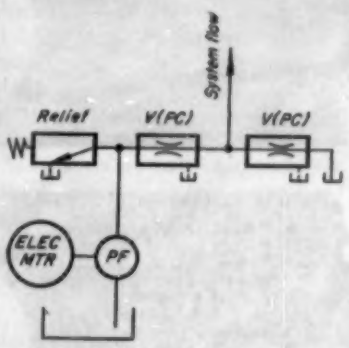
Letters to the Editor

Continued

This organization has a Packings and Seals Section. It is hoped that in a relatively short time the products divisions of NFPA will formulate and publish suggested industry-wide practices. The NFPA holds two annual meetings, a Spring Annual meeting and a Fall meeting. The Fall meeting is scheduled for the Hotel Commodore, New York City, September 8 and 9.

Low Capacity Flow Control Valving

In your June issue there was a letter (pages 26, 30) from Mr. Anthony R. Patterson, Plant Engineer of Raybestos-Manhattan, Inc., inquiring as to a suitable flow control valve for ranges of from 0 to 20 cubic inches per minute. We have solved this problem in the past by the use of two small capacity flow control valves as shown on the attached sketch. The first flow control



valve is set at a slightly higher capacity than the second flow control valve and the difference in the settings between the two flow control valves is the amount of metered oil going into the system. The second flow control valve bleeds back to the tank. In this manner the first flow control valve can be set, at say, 25 cubic inches per minute and the second flow control valve set at 24 cubic inches per minute with the result in flow of only one cubic inch per minute.

R. L. HAYMAN,
President,
Haskel Engineering & Supply Co.

Thank you, Mr. Hayman. We have forwarded a copy of your letter and sketch to Mr. Patterson.

Continued on page 26

NOW

A Midget 4-WAY Solenoid Valve . . . For Controlling Small Double Acting Cylinders

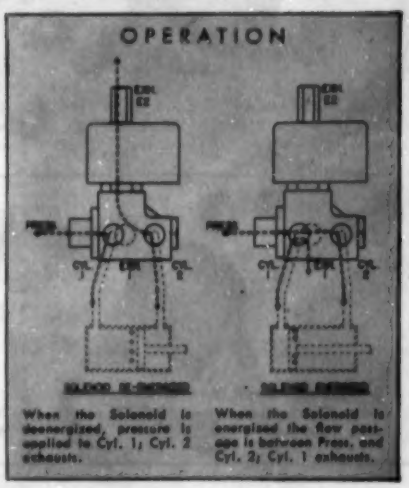
Pipe Size: ¼"
Pressures:
Maximum 125 psi
Minimum 10 psi

Fluids Handled:
Air, Water, Light Oil, Non-Corrosive Gases and Liquids

Extremely Compact to Meet Critical Space Requirements

FEATURING:

- **Compactness** — 4 15/32" Overall Height; 1 31/32" Width; 2" Depth; (With Standard NEMA 1 Solenoid Enclosures).
- **Rapid Operation** — Up to 400 cycles per minute.
- **Ruggedness** — Tested for millions of maintenance free operations.
- **Low Power Consumption** — Only 10 watts!
- **Tight Seating**—Assured by integral crown seats and resilient and nylon discs.
- **Standard, Watertight or Explosion-Proof Solenoid Enclosures available.**
- **Simplicity** — Single Operating Coil — only one electrical connection to be made.
- **Forged Brass Body** — Insures complete freedom from porosity.


OPERATION
When the Solenoid is deenergized, pressure is applied to Cyl. 1; Cyl. 2 exhausts.
When the Solenoid is energized the flow passage is between Press. and Cyl. 2; Cyl. 1 exhausts.

NOW ASCO has available **a complete line of Midget 2, 3, & 4-Way Solenoid Valves** — an important addition to the thousands of types and sizes in the standard ASCO line.

We also design and manufacture Control Panels to provide "Single Source Responsibility" for the Complete Automatic Control. ASCO Electromagnetic Control Equipment includes Close Differential, Time Delay, and Magnetically or Mechanically Held Relays, Contactors, Automatic Transfer Switches and Remote Control Switches.

ASCO Solenoid VALVES

Automatic Switch Co.

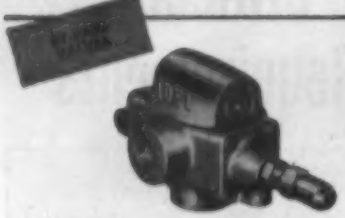
385-H LAKESIDE AVENUE · ORANGE, NEW JERSEY

ADEL *Industrial Hydraulic Equipment*

for PEAK PERFORMANCE ADEL Hydraulic Valves and Pumps are setting new and ever higher standards for precision in manufacturing and efficient performance in operation. Following are but a few of the wide variety of models to meet all operating conditions.

For 1000 psi service with rated capacities at 1800 rpm of from 1.5 to 46.8 gpm.

4-way valves with spring-centered, spring-offset, and 1, 2, or 3 position detent action. 1500 psi. Flows to 28 gpm.



Relief, Sequence and Unloading valves. Direct or remote operation, 50 to 1500 psi range.

Compensated type maintains constant flow over wide differential pressure range. No drain line required. 1500 psi.

2 or 3 position detent. With or without dog or lever. Can be used as 4-way valve in small circuits. 1000 psi.

Valves allow free flow in one direction only. Many variations available. 3000 psi.

A FEW SELECT TERRITORIES ARE STILL AVAILABLE TO PROGRESSIVE DISTRIBUTORS OF HYDRAULIC EQUIPMENT. INQUIRIES INVITED.

For complete engineering specifications and counsel, Address: ADEL DIVISION—GENERAL METALS CORPORATION, 10771 Van Owen Street, Burbank, California.

ADEL LEADER IN HYDRAULICS

DIVISION OF GENERAL METALS CORPORATION · Burbank, Calif.

Manufacturers of Industrial Hydraulic Valves and Pumps

DISTRIBUTORS: AIR & HYDRAULIC ENGINEERING CO., NEW HAVEN, CONN. • RUSS CHAMBERLIN COMPANY, PORTLAND, OREGON • J. BOYD COATES, PHILADELPHIA, PA. • FRANK T. DONNELLY COMPANY, PITTSBURGH, PA. HASKEL ENGINEERING & SUPPLY CO., SAN FRANCISCO, CALIF. • HASKEL ENGINEERING & SUPPLY CO., GLENDALE, CALIF. • HYDRAULIC BRAKE SUPPLY CO., PHOENIX, ARIZ. • LINCOLN SUPPLY CO., PROVIDENCE, R. I. • SCOTT EQUIPMENT AND ENGINEERING COMPANY, DAYTON, OHIO • H. P. SODERLING CO., SEATTLE, WASH. • ROBERT TAYLOR & SONS, SALT LAKE CITY, UTAH • WYATT SALES COMPANY, CLEVELAND, OHIO • CORBY SUPPLY COMPANY, ST. LOUIS, MO. • INDUSTRIAL AIR & HYDRAULIC EQUIPMENT CO., DETROIT, MICH.

Letters to the Editor

Continued

Special Dial Gage

We wish to contact a supplier of a hydraulic gage of about 2 inches diameter, external, with dial calibrated to 25 tons, working against a two inch cylinder. Could you furnish me with information as to where I may obtain such an "animal"?

IKE MCCOY,
McCoy Machinery

We believe that such a gage as you describe would not be obtainable from stock from any of the leading manufacturers of gages. It would probably be necessary to either ask one of the instrument or gage companies to make up a special gage for you, or to find a shop in your territory that would be capable of modifying the dial of a standard 2 inch diameter hydraulic gage for your purpose. Representatives of dial gage manufacturers, possibly one of your regular sources of supply should be able to advise you.

Regenerative Circuit

Along about 1949-1950 there appeared in APPLIED HYDRAULICS an article on the principle of regeneration and how it could be applied to a hydraulic cylinder so that equal speed and force could be obtained in either direction by having the rod area equal to one half the cylinder barrel area. If I remember correctly there was also some discussion on various types of valving for automatic reciprocation of the cylinder. If possible will you forward two reprints of this article?

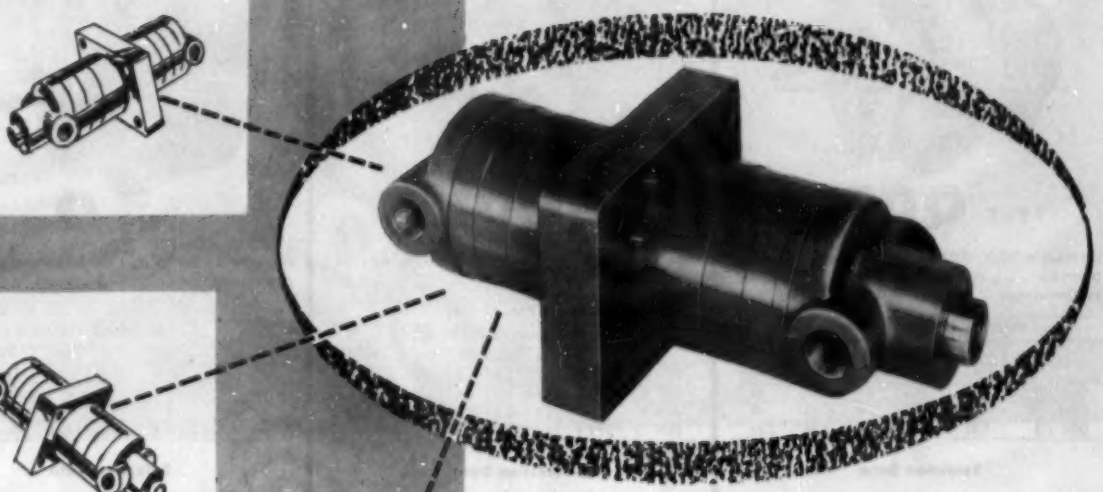
E. E. DORKINS,
Ottowa Steel Products, Inc.
Industrial Division

You have an excellent memory. The article you refer to was "The Regenerative Circuit" by Kenneth Court and it appeared in the January, 1949 issue of APPLIED HYDRAULICS. This issue has long been out of print. The article, "Differential Circuits," appearing this month will be of interest to you.

Continued on page 30

Pathon LEADS THE WAY AGAIN

with the NEW . . . MORE VERSATILE INTERMEDIATE FLANGE MOUNTING



YOU CAN CHOOSE THE POSITION BEST SUITED TO YOUR OPERATION

Now you can have complete freedom of decision on mounting Pathon Hydraulic Cylinders on your machinery without special mounting brackets. The Standard Pathon Intermediate Flange mounting is rotatable to any position to permit mounting with pipe parts in any position. Available in both the R.H. 2000 P.S.I. and Q.H. 1000 P.S.I. Series, it combines all the important advantages of all Pathon Hydraulic Cylinders.

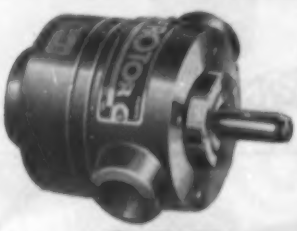
Pathon MANUFACTURING CO.

2833 PACIFIC AVENUE
CINCINNATI 12, OHIO

THAT FINE LINE OF PERFECTION

There's a GEROTOR HYDRAULIC PUMP *to meet your requirements!*

The GEROTOR line of precision engineered hydraulic pumps is designed to fill the requirements of the majority of hydraulic equipment users. The three standard GEROTOR models cover a range of g.p.m. delivery from .4 g.p.m. to 40 g.p.m. Check the selection data for the pump to fill your needs.



TYPE QDB

Gerotor's NEW QDB series of small capacity pumps . . . the last word in precision engineering.

TYPE	DELIVERY G.P.M. — 1800 R.P.M. DISCHARGE PRESSURE P.S.I.				
	0	250	500	750	1000
QDB .4	.42	.40	.38	.35	.31
QDB .75	.84	.80	.78	.73	.66
QDB 1.5	1.67	1.62	1.57	1.50	1.42

Selection Data

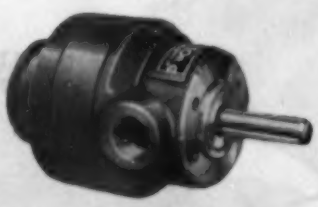
TYPE	HORSEPOWER REQUIRED — 1800 R.P.M. DISCHARGE PRESSURE P.S.I.				
	0	250	500	750	1000
QDB .4	.08	.16	.24	.33	.41
QDB .75	.13	.27	.41	.56	.71
QDB 1.5	.16	.42	.70	1.00	1.28

PRESSURE—Maximum continuous operating pressure is 1000 p.s.i.

SPEED—Standard design speed is 1800 r.p.m. Specific recommendations are made for applications at other speeds.

ROTATION—Standard rotation is clockwise facing shaft end. Counter-clockwise rotation is available.

OIL—Hydraulic oils with viscosity of approximately 300 s.s.u. at 100° F. are recommended.



TYPE QDH

The QDH . . . popular intermediate size of the Gerotor line

TYPE	DELIVERY — G.P.M. AT 1200 R.P.M. DISCHARGE PRESSURE P.S.I.						
	0	250	500	750	1000	1200	1500
QDH 3	3.3	3.2	3.1	3.0	2.9	2.7	2.5
QDH 5	5.6	5.4	5.3	5.2	5.1	4.8	4.4
QDH 8	8.6	8.5	8.4	8.3	8.2	8.1	7.8
QDH 12	12.9	12.8	12.7	12.5	12.3	12.2	11.8

Selection Data

TYPE	HORSEPOWER REQUIRED AT 1200 R.P.M. DISCHARGE PRESSURE P.S.I.						
	0	250	500	750	1000	1200	1500
QDH 3	.25	.7	1.2	1.6	2.1	2.5	3.4
QDH 5	.33	1.1	1.8	2.5	3.2	3.7	4.6
QDH 8	.4	1.5	2.7	4.2	5.4	6.3	7.9
QDH 12	.5	2.3	4.2	6.1	8.0	9.6	11.7

PRESSURE—Maximum continuous operating pressure is 1200 p.s.i., maximum intermittent 1500 p.s.i.

SPEED—Standard design speed is 1200 r.p.m. Specific recommendations are made for applications at other speeds.

ROTATION—Standard rotation is clockwise facing shaft end. Counter-clockwise rotation is also available.

OIL—Hydraulic oils with viscosity of approximately 300 s.s.u. at 100° F. are recommended.

TYPE O

Gerotor Series O . . . when larger capacities are needed

TYPE	DELIVERY — G.P.M. AT 1200 R.P.M. DISCHARGE PRESSURE P.S.I.				
	0	250	500	750	1000
O-20	20.0	19.5	18.8	18.0	17.2
O-25	25.0	24.5	24.0	23.2	22.2
O-30	31.2	31.0	30.5	29.8	29.0
O-40	43.0	42.5	42.0	41.5	40.0

Selection Data

TYPE	HORSEPOWER REQUIRED AT 1200 R.P.M. DISCHARGE PRESSURE P.S.I.				
	0	250	500	750	1000
O-20	1.0	4.0	7.2	10.5	13.5
O-25	1.5	5.0	8.6	12.0	15.6
O-30	2.0	6.5	10.9	15.5	19.5
O-40	3.0	9.0	15.0	21.0	27.5

PRESSURE—Maximum continuous operating pressure is 1000 p.s.i., except type O-40, which is recommended for only intermittent duty at 1000 p.s.i.

SPEED—Standard design speed is 1200 r.p.m. Specific recommendations are made for applications at other speeds.

ROTATION—Standard rotation is clockwise facing shaft end. Counter-clockwise rotation is available.

OIL—Hydraulic oils with viscosity of approximately 300 s.s.u. at 100° F. are recommended.

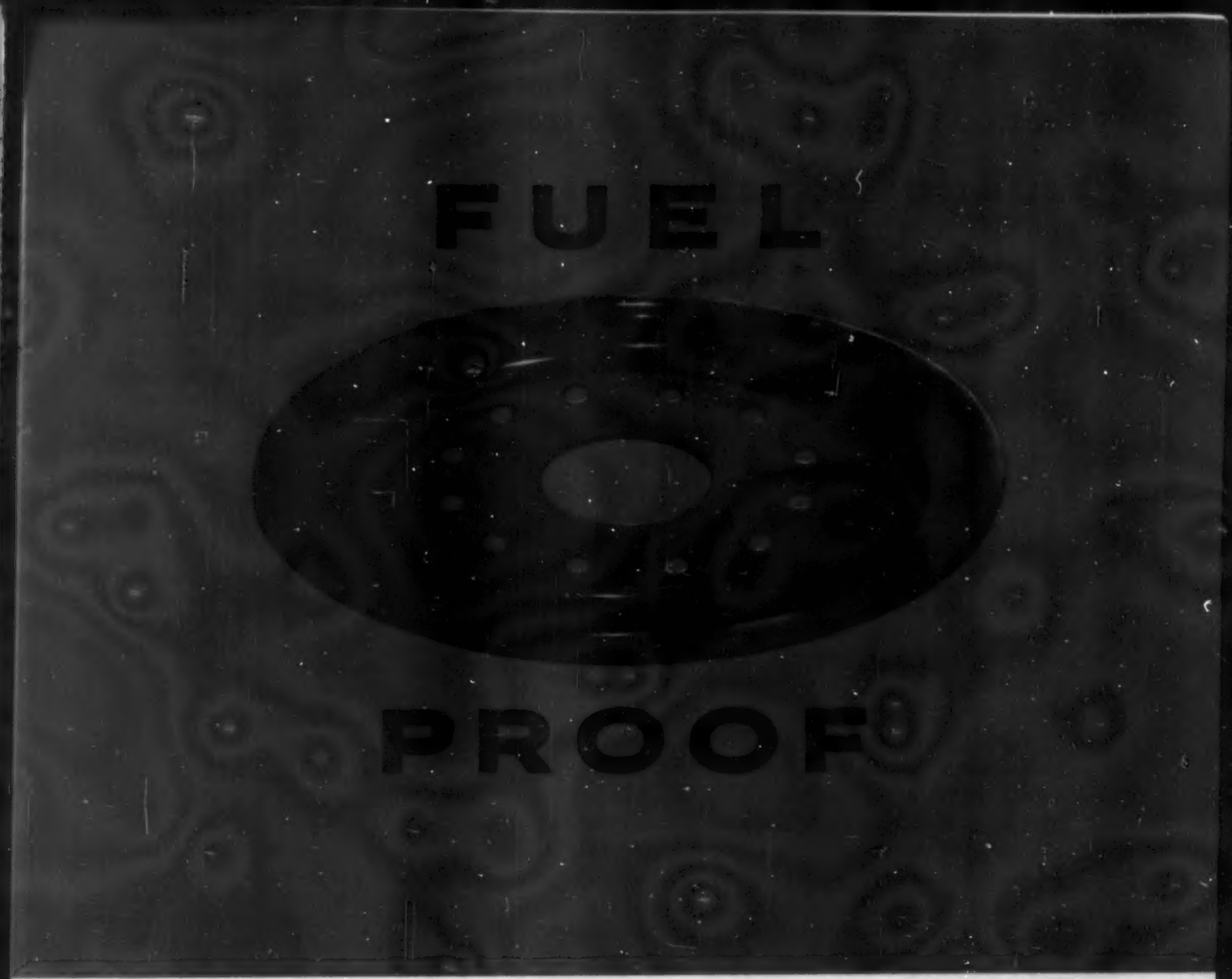
Whatever your needs in hydraulic pumps . . . consult the GEROTOR engineers. Write for FREE literature and information, no obligation, of course.

GEROTOR MAY CORPORATION
P. O. Box 86—Baltimore 3, Maryland

GEROTOR

HYDRAULIC PUMPS — HYDRAULIC MOTORS

Pneumatic Bin Evacuators — Precision Contract Manufacturing



FORCE-FEEDS 10,000 HUNGRY HORSES

Making jet engines thrive on strange diets in many climates requires the most exacting specifications in a pliable part. That's why C/R Sirvene (synthetic rubber) was the logical choice for this fuel control regulator diaphragm. It handles fuels ranging from kerosene up through the aromatics. It feeds them fast, under high pressure, and does the job dependably at −65° and 200°F. plus. Like all Sirvene parts, this diaphragm is completely custom developed—through design, compounding of oil-resistant elastomers, molding, and laboratory-like control of production. Also, it is the result of cooperation . . . the complete cooperation that C/R engineers will be glad to provide for your similar problems.

FOR YOU: We will be pleased to send you our book "Engineering with Sirvene," on request.

C/R SIRVENE

SCIENTIFICALLY COMPOUNDED ELASTOMERS

See Sweet's Product Design File 1e / Ch

CHICAGO RAWHIDE MANUFACTURING COMPANY

1301 Elston Avenue SIRVENE DIVISION Chicago 22, Illinois

Representatives in these Principal Cities: Boston • New York • Syracuse • Buffalo • Philadelphia • Pittsburgh • Cincinnati • Cleveland Detroit • Peoria • Minneapolis • Wichita • Tulsa • Houston • Los Angeles • San Francisco • Seattle

Other **C/R** *products*

Oil Seals: Shaft and end face seals for all types of lubricant retention and dirt exclusion • **Conpor:** Controlled porosity mechanical leather packings and other sealing products • **Sirvis:** Mechanical leather boots, gaskets, packings and related products.

Circle 21 on Reader Service Card

special tanning means special advantages

Tannate is the tradename for the special tanned leather developed and produced by J. E. Rhoads and Sons especially for the manufacture of mechanical leather packings. Tannate packings combine all these special advantages:

1. The extra strength of Tannate Leather enables these packings to withstand the highest pressures with a minimum of cold flow or extrusion.

2. Special tanning gives Tannate Packings a low coefficient of friction which means longer life because little heat is generated.

3. Rhoads Laboratory has developed a variety of impregnants which permits packings to operate from a few ounces pressure to many thousands of pounds psi. Tannate packings can be made flexible or rock hard to meet your requirements.

4. Tannate special tanned leather is molded with a minimum of strain because it is a flexible leather. This permits precision molding which insures a leak-proof seal.

5. Tannate Packings are job-engineered from start to finish, providing an effective seal against glycerin, alcohol, mineral, fish and animal oils, also water, vegetable or any other non-caustic, non-acid fluids.

If you have a special need for a packing that will seal better and last longer, specify Tannate Leather Packings.

Sales representatives in Principal Industrial Areas.

RHOADS
INDUSTRIAL LEATHERS

PHILADELPHIA • NEW YORK • CHICAGO • ATLANTA

Letters to the Editor

Continued

Radial Pumps for Scrap Metal Balers

We have noticed your reply in the June issue (page 30 in the Letters to the Editor column) to Mr. Allen M. Steel of the Scovill Manufacturing Company, Waterbury, Conn., covering the type of pumps used on scrap metal balers. We have been using a radial type of pump on our balers for some time and have so informed Mr. Steel.

R. D. HAAS
Metalworking and Process Press Division,
The Hydraulic Press Manufacturing Co.

Thanks Mr. Haas, for your information regarding the use of radial type pumps on scrap metal balers. Of course, we did not infer that only triplex pumps were used on such applications.

"Beginners Course in Basic Pneumatics"

For well over a year I have followed a series of articles you published under the title "A Beginners Course in Basic Pneumatics". I thought that this information was very good and much needed. If possible, will you forward me reprints of this entire series. I would also like your permission to reproduce this series of articles for distribution to our sales organization.

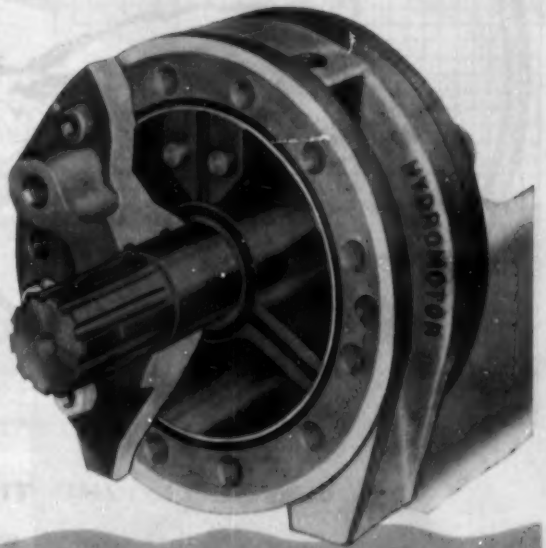
C. E. FLORA,
Compressor Division
Binks Manufacturing Co.

We are pleased to tell you that we will be able to furnish reprints of "Beginners Course in Basic Pneumatics" very shortly. The material is now in the hands of the printer and copies should be ready early in September. The reprint runs 72 pages and in addition to the complete series some additional material and an index have been added. The pneumatics reprint will sell for $1.00 *per copy. We will be glad to quote on quantity orders. We are now accepting reservations for copies. As a substantial printing has been ordered, we will be able to take care of company orders in time to put copies in the hands of salesmen for the fall season.*

BONNOT *Hydromotor*

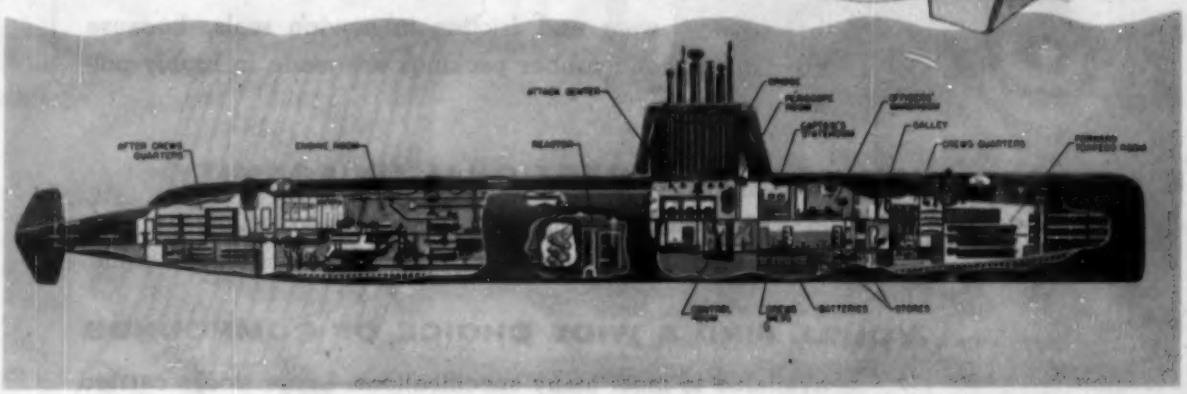
GOES TO THE NATION'S DEFENSE

aboard the *Nautilus*



Aboard the Navy's first atomic-powered submarine Nautilus, the space-saving, weight-saving Bonnot **Hydromotor** is efficiently providing RECIPROCATING ROTARY POWER. And in industry, these unique hydraulic actuators are replacing out-moded methods of "precision control, manipulation and movement."

In brief, the versatile Bonnot **Hydromotor** develops instant, full torque in either direction—operates with oil, water or air—may



be installed anywhere, at any angle—is completely sealed and self-contained—may be stopped and reversed at any point.

Simple controls permit an infinite and variable range of speeds at any stroke length up to an arc of 280 degrees. Standard models develop 150 to 300,000 inch-pounds torque. Double vane units (same size) produce double torque—up to 600,000 inch-pounds—through 100 degree travel limit.

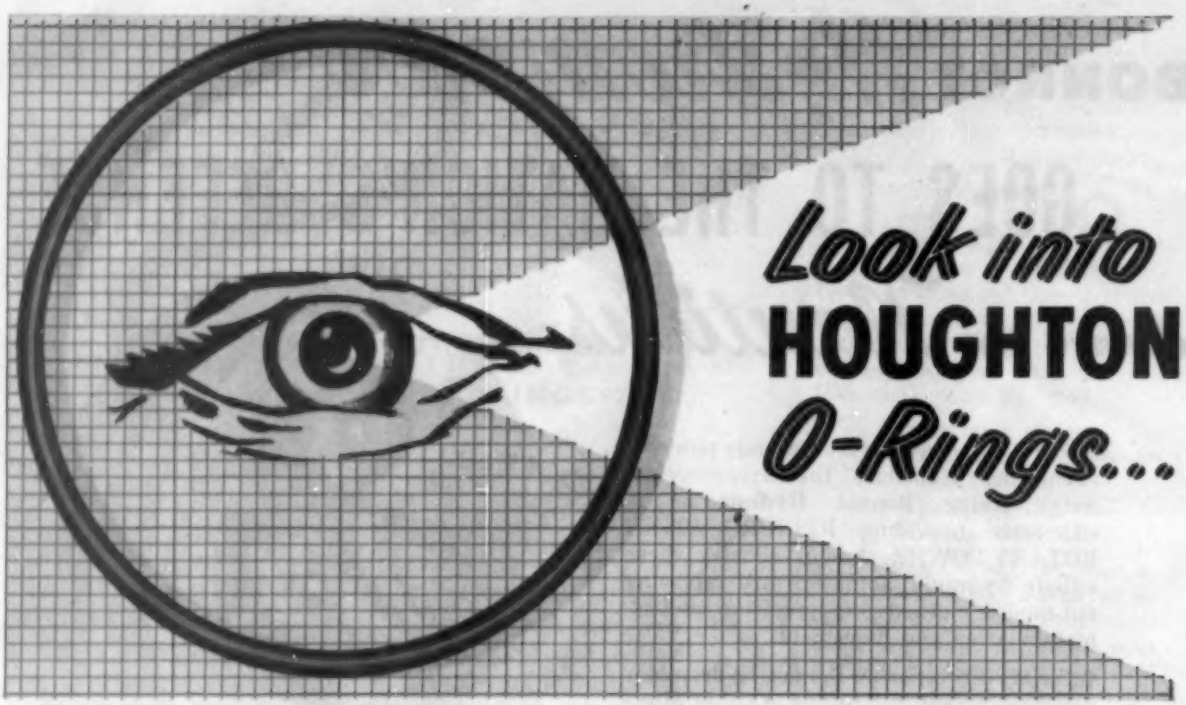
Larger and smaller sizes constantly under development or already custom-built.

Let us show YOU how Bonnot Hydromotors can help increase YOUR product efficiency or lower plant operating costs. Write for Bulletin 521 describing applications and engineering details . . . OR SUBMIT DETAILS OF YOUR SPECIFIC NEEDS.

For Lowering • Revolving • Lifting • Pushing
Pulling • Swinging • Opening • Closing • Clamping
Turning • Indexing • Oscillating, etc.

Hydromotor DIVISION

THE BONNOT COMPANY • CANTON 2, OHIO



Look into HOUGHTON *O-Rings...*

...YOU'LL FIND THE SMOOTH SURFACE FINISH

that reduces wear and friction in moving seals, because Vix-Syn synthetic rubber packings are made in highly polished molds;

...YOU'LL SEE EXCEPTIONAL UNIFORMITY

in dimension and density—a close-grained structure developed by Houghton engineering that assures longer service life.

...YOU'LL FIND A WIDE CHOICE OF COMPOUNDS

available to meet many specifications. Large stocks carried on most sizes, for prompt delivery.

VIM and VIX-SYN PACKINGS

Synthetic Rubber, Leather and Rubber-Impregnated Leather; all types and sizes described in Houghton's "Packing Standards Book" which is accepted as standard by industry. Get your copy—and latest Packings bulletins—from the Houghton Man or E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

...products of E. F. HOUGHTON & CO.
PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service...

What's this?

. . . a hydraulic pump unit. But there's more to it than meets the eye.

The PRESSURE it develops is infinitely ADJUSTABLE, yet NO RELIEF VALVE is used, and thus no power is wasted.

If desired, the VOLUME of oil delivered can also be infinitely ADJUSTED . . . or reversed . . . WITHOUT using a FLOW CONTROL VALVE.

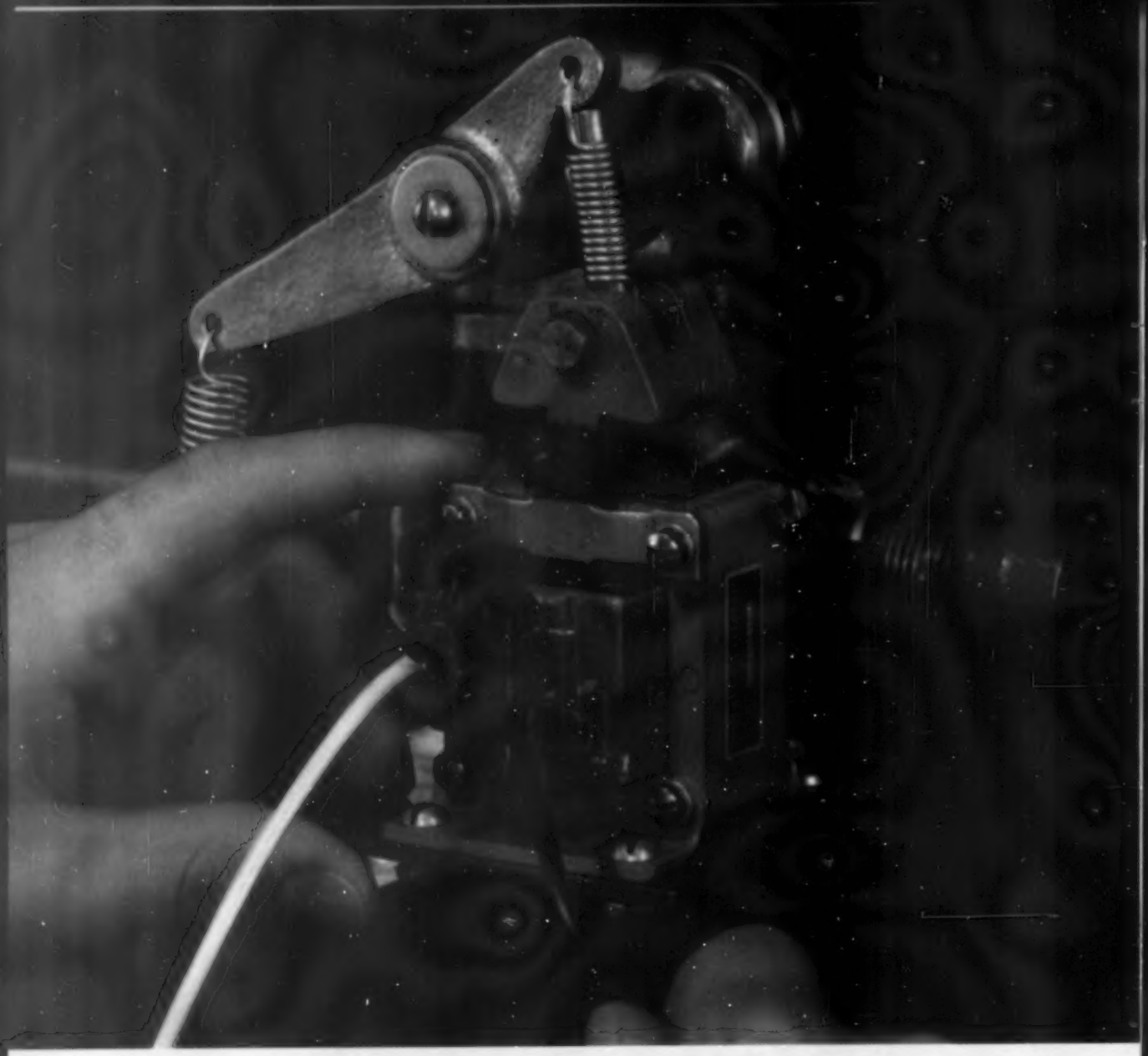
NO OIL COOLER is normally required, even though this unit can run CONTINUOUSLY at 3000 p.s.i.

All the types of CONTROLS for this pump are out where they can be seen . . . not hidden inside. They are SIMPLE both in basic design and operation.

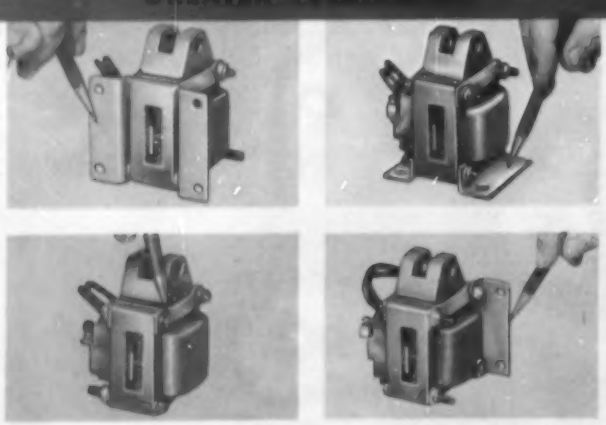
And the variety of controls . . . well, why not write for the details as applicable to your particular requirements!

Quality EQUIPMENT for *Quality* PERFORMANCE

BENJAMIN LASSMAN & SON Route 8, GLENSHAW, PA

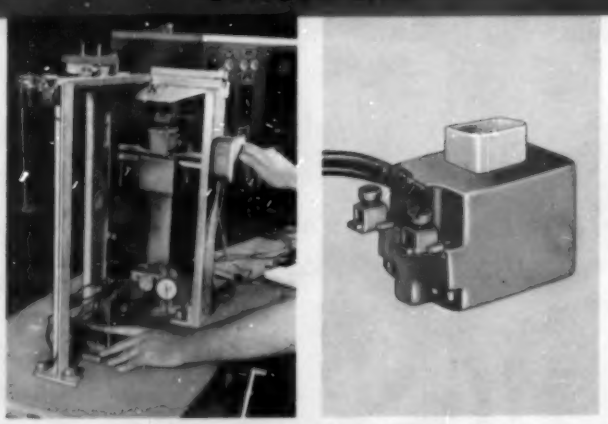


GREATER FLEXIBILITY



New General Electric solenoids mount in five positions — end, right- or left-side, throat, or with thru-bolts. Both leads and built-in terminal board on strongbox coils give added flexibility.

LONGER LIFE



Laboratory tests proved the new strongbox solenoid has much longer life. Long life results from design features such as strongbox coil, and double-strength, spring-steel mounting brackets.

G. E. ANNOUNCES

NEW STRONGBOX SOLENOIDS

The all-new line of General Electric industrial solenoids was designed to include the features you requested. From your requirements, design specifications for the new line were written — and here is the new, more economical solenoid you asked for.

GREATER FLEXIBILITY

New solenoids mount in five positions. Mounting brackets can be moved to any of the four sides, or thru-bolts can be used. Both leads and built-in terminal board on strongbox coils make either type wiring immediately available.

LONGER LIFE

New General Electric solenoids last longer because of new design components. Strongbox coils, enclosed layer wound Formex* windings, give long electrical life. New double-strength, spring-steel mounting brackets contribute to added life. New design also includes glass fabric plunger guide, and larger linkage-pin hole.

COMPLETE RATING COVERAGE

Complete coverage is supplied by nine ratings in each of the following forms (nominal ratings at maximum stroke).

3.0 to 40 lbs in ½ inch pull forms
1.4 to 36 lbs in 1 inch pull forms
2.0 to 33 lbs in ½ inch push forms
4.3 to 28 lbs in 1 inch push forms

Sizes are available in 60, 50 and 25 cycle, and d-c forms. Voltage ratings are from 24 to 600 volts.

SMALLER SIZE

22 percent smaller for the same power ratings, new General Electric solenoids will reduce space problems when mounting solenoids in your equipment. Smaller enclosures and reduced material costs make new solenoids more economical.

FOR MORE INFORMATION contact your nearest Apparatus Sales Office, or Distributor, or write Section 730-58, General Electric Company, Schenectady 5, N. Y. Ask for Bulletin GEA-6215.

*Reg. Trademark. General Electric Co.

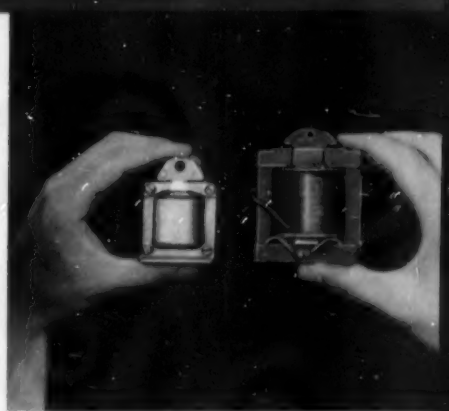
Progress Is Our Most Important Product

GENERAL ELECTRIC

COMPLETE RATING COVERAGE

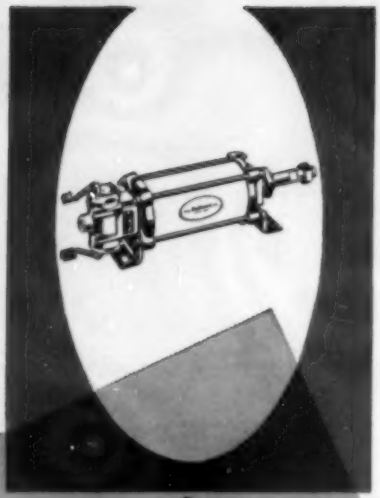
Supplied by nine force ratings in each of the forms, new strongbox solenoids are available in both push and pull forms, at one-half and one inch strokes. All these sizes are available in d-c, 25, 50, and 60 cycle a-c, with voltage ratings from 24 to 600 volts.

SMALLER SIZE



22% smaller for the same power ratings, new General Electric solenoids will reduce space problems in your equipment.

Hydraulic control of air cylinder operation gives absolute smoothness of piston rod movement



Compressed air has "bounce" and "springiness," ideal for many operations. But this "bounce" and "springiness" of air can be troublesome when air cylinders are used to feed tools to work.

With the Bellows Hydro-Check you can combine the speed, economy and flexibility of air power with the smoothness of hydraulics. The Bellows Hydro-Check gives an air-powered piston rod unparalleled smoothness, completely free from chatter.

Using the Bellows Hydro-Check, with any air cylinder, you can advance the tool to the work at a high rate of speed, check the advance as the tool reaches the work, feed the tool through the work at the feed rate best suited for tool and material, and with rapid return of tool to starting position.

Result: Almost twice as many minutes actual machining time each hour; longer tool life through better control of feed rate; fewer rejects.

Write today for

BULLETIN HC-600R

"Hydraulic Control of Air Power"

Dept. AH-954

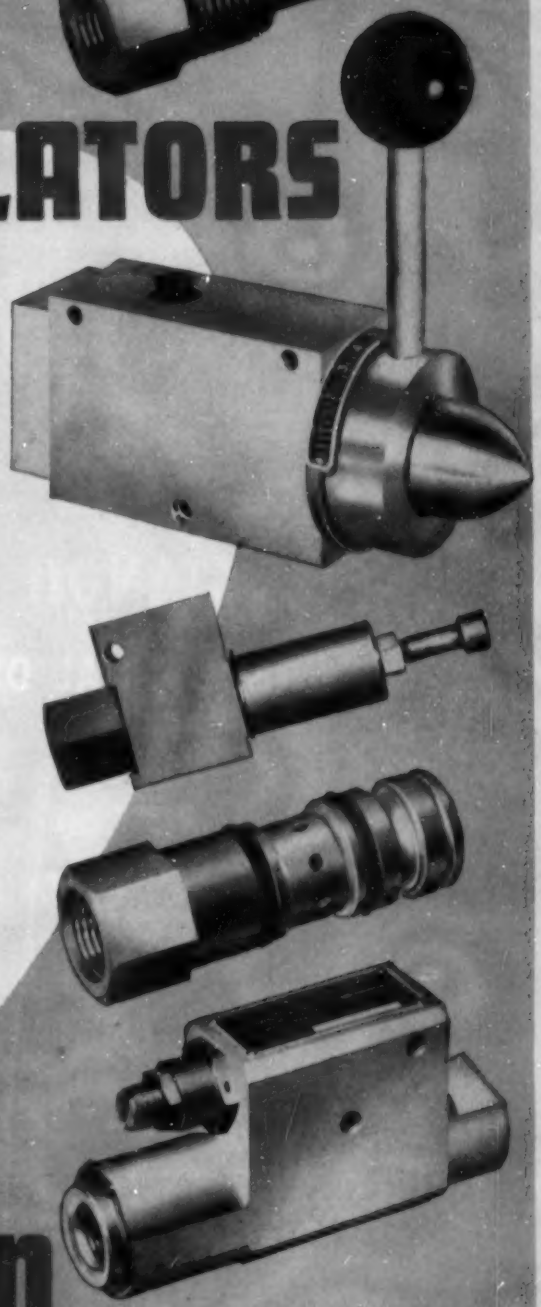
The Bellows Co.

AKRON 9, OHIO

879-A

WATERMAN

FLOW REGULATORS



WATERMAN ENGINEERING COMPANY is the leading manufacturer of flow regulators and flow controlling devices of the pressure compensated type.

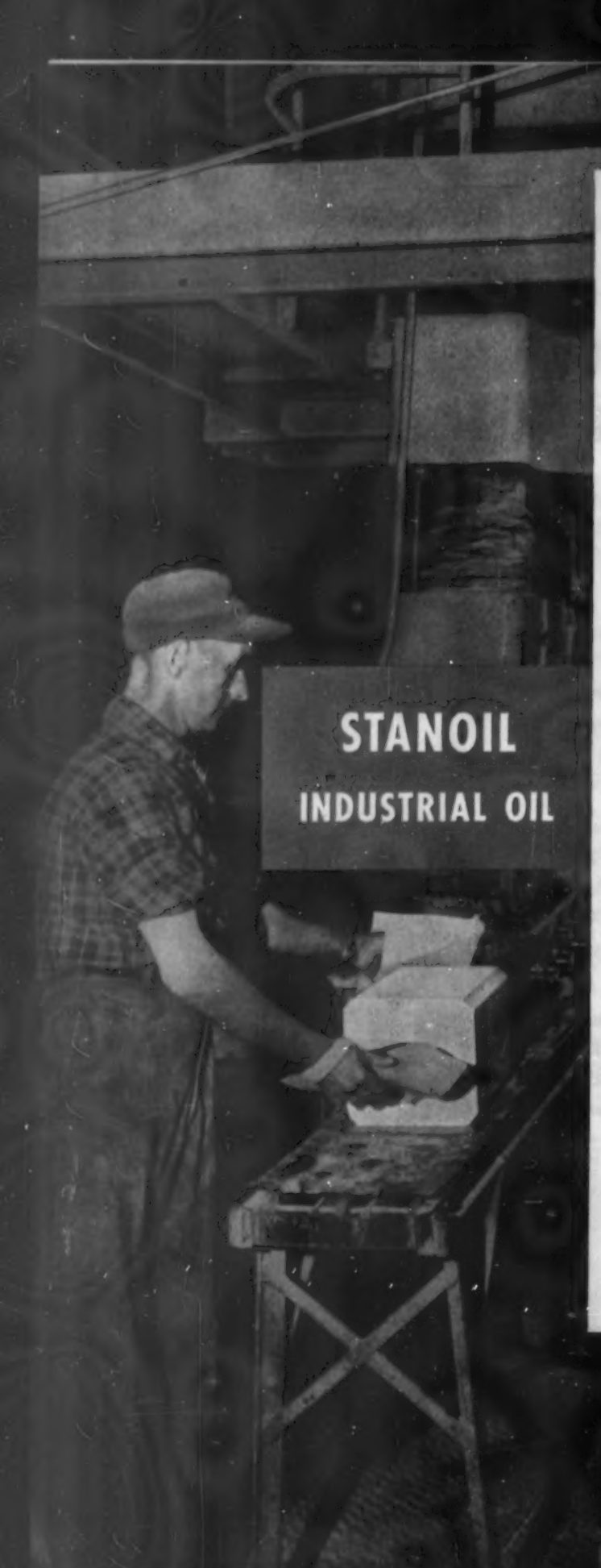
WATERMAN has furnished hundreds of thousands of flow regulators to all types of industries using hydraulics and as a result, has emerged as a specialist in the field of flow control and flow regulation. This has resulted in the accumulation of a wealth of information on flow control applications. **WATERMAN** stands ready to apply this experience and know-how to your flow control problems.

Although a variety of models are being manufactured, there are certain characteristics that are common to all. These characteristics enable the designer to quickly and conveniently determine whether standard **FLOW REGULATORS** will meet his requirements or whether special regulators are required.

The photos shown on this page illustrate the standard and special types of **WATERMAN FLOW REGULATORS**. The principles embodied in the standard units are readily adaptable to meet a variety of conditions and the same engineering skill and high standards of manufacture will be applied to your special requirements.

Write for latest bulletin A.

WATERMAN
ENGINEERING COMPANY
725 CUSTER AVENUE • EVANSTON, ILLINOIS



How a good oil earns its salt!

Here's a "salty" story about an oil with staying power. When this 100 ton hydraulic press was to be installed by the Morton Salt Company in their Manistee, Michigan plant, officials outlined to a Standard Oil lubrication specialist some of the rigid specifications the required oil should have. The new press would operate under a heavy load five days a week, and since the original fill would be large — 22 barrels — it was important that the oil installed resist oxidation and remain in good condition for long periods.

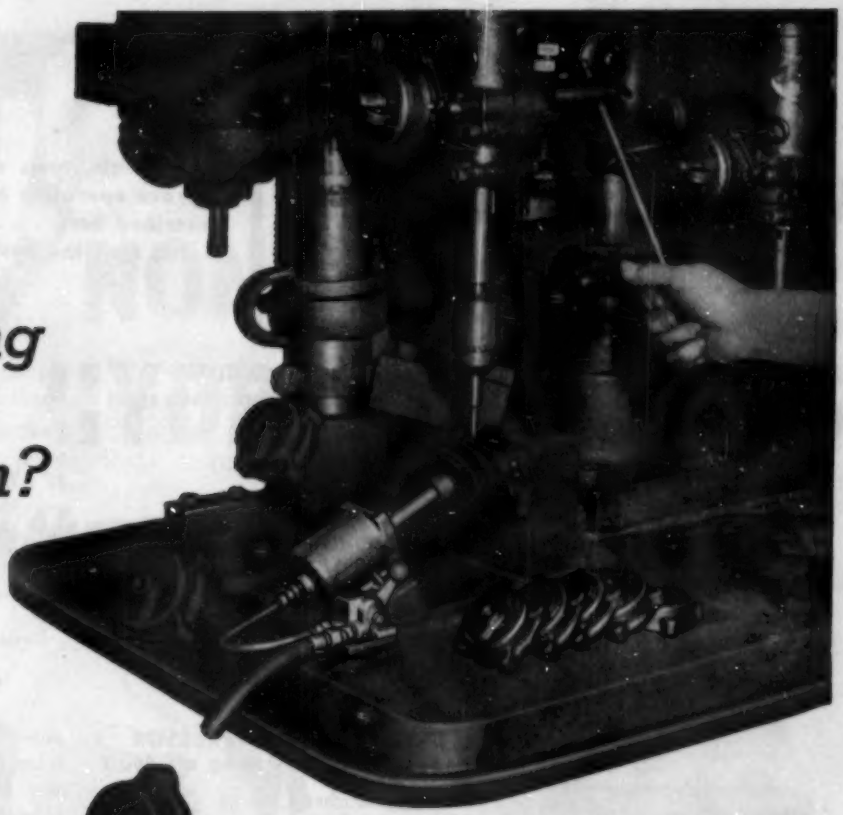
The Standard man recommended STANOIL Industrial Oil #25, a many-purpose oil having high stability and effective rust protection. In over seven years of hard service, the oil has never been changed! During this period, periodic tests of oil samples have shown that STANOIL, despite hard service and high oil-operating temperatures, has maintained a lubricating quality comparable *with a new oil.*

For information on how *you* can best use STANOIL in *your* plant, check with a specially trained and experienced Standard Oil lubrication specialist. He can help you save time and money. Call your nearest Standard office, or write to Standard Oil, Chicago.

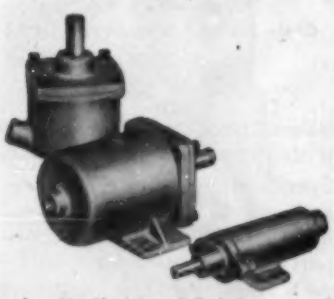
STANDARD

STANDARD OIL COMPANY
(Indiana)

Clamping Problem?



SCHRADER has the answer!



Schrader Air Clamping Cylinders are available either base or leg mounted, in 1", 2½" and 3" diameters delivering a 2" or 1" stroke. A wide selection of Schrader Valves is available to operate this equipment.

Schrader
REG. U. S. PAT. OFF.

Leaders in air control since 1844

The **Schrader Air Clamping Cylinder** is actually a bantam air cylinder that can *add several minutes* to each worker's production hour . . . eliminate the need for slow, manual clamps.

Think of all the clamping operations in your own shop. Milling machines . . . drill presses . . . power presses . . . welders . . . gluers — and many dozens of other machines that are now idling for ten or fifteen seconds while operators go through slow clamping operations. Why not save time — and operator annoyance — with fast, convenient Schrader Clamping Cylinders, as so many other industrial plants have already done? Remember, you can mount these Schrader Clamping Cylinders anywhere — and actuate them automatically or manually.

For full details on the models available — or any of the hundreds of air control products in the complete Schrader Line — write today. Or, if you prefer, fill out the coupon below.

A. Schrader's Son
Division of Scovill Manufacturing Company, Incorporated
456 Vanderbilt Avenue, Brooklyn 38, N. Y., Dept. B-5

I am interested in more information on _____

Name _____ Title _____

Company _____

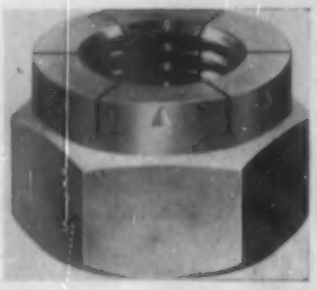
Address _____

← Circle 108 on Reader Service Card

Circle 104 on Reader Service Card

NEW PRODUCTS

Components, tools and equipment designed to improve operation of fluid power systems are described here . . . for more information fill in and mail the post card bound in this issue.



ALUMINUM LOCKNUT
. . . 65 percent lighter than steel

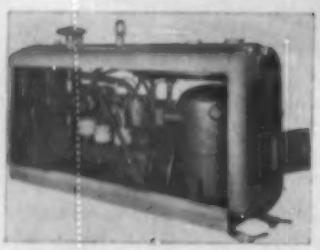
Designation: 105 FS

Sizes: 6-32, 8-32, 10-32, ¼-28 and 5/16-24

Design: All metal self locking locknut has been made out of high tensile aluminum. It is one piece and has the torque and strength characteristics of a standard all steel nut. Weighs much less than steel.

Features: Made of 24 ST aluminum, a far stronger alloy than 17 ST from which the nuts were previously manufactured. Has the same self-locking feature as the company's steel Flexlocs.

Standard Pressed Steel Co., Jenkintown, Pa.
Circle 201 on Reader Service Card

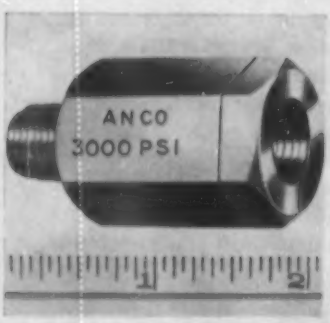


UTILITY AIR COMPRESSOR
. . . for powering air tools

Designation: Utility

Features: 105 cfm compressor has improved features including better air cleaning and cooling through the use of oil bath air cleaners and a pressurized cooling system. The same basic engine is used as in the 105 portable. Ideal for mounting crosswise behind a truck cab allowing plenty of extra room for other equipment and materials. Overall width of the unit is 25 in, and the overall length of 82 in, does not exceed the maximum truck width regulation.

Le Roi Company, Milwaukee 14, Wis.
Circle 202 on Reader Service Card



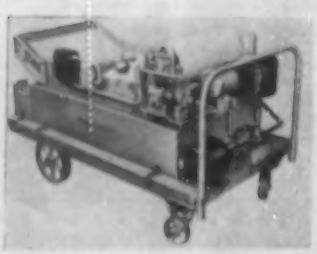
GAGE PROTECTOR VALVE . . . . easily cleaned

Size: ¼ in and ⅜ in NPT. Female threads are used on the gage side, male threads on the pressure side of the line.

Features: Pressure gage failures are reduced by the valve. Ensures more accurate gage readings because it does away with "shimmy". Most pressure gage failures are due to shock and wide pressure fluctuations.

Specifications: Small, compact and can be used for either liquids or gases. No moving parts. Available in steel (0-5000 psi), brass (0-3000 psi), or stainless steel (0-5000 psi).

Anco Division, American Associates, Inc., Providence 5, R. I.
Circle 203 on Reader Service Card



PORTABLE FILTRATION UNIT
. . . has disposable filter

Features: Portable filtration unit incorporates the Delpark disposable belt-type filter. Mounted on casters, can be transported for periodic filtration of various liquids and oils which do not require continuous filtration. Uses of a variety of filter media for numerous filtration requirements and may be used on quenching oils, cutting oils, coolants, hydraulic oils, test stand oils.

Industrial Filtration Company, Lebanon, Indiana
Circle 204 on Reader Service Card

NOW! FILTERS FOR NON-FLAMMABLE HYDRAULIC FLUIDS

Another FIRST for Marvel!

SUMP TYPE
(Cutaway)

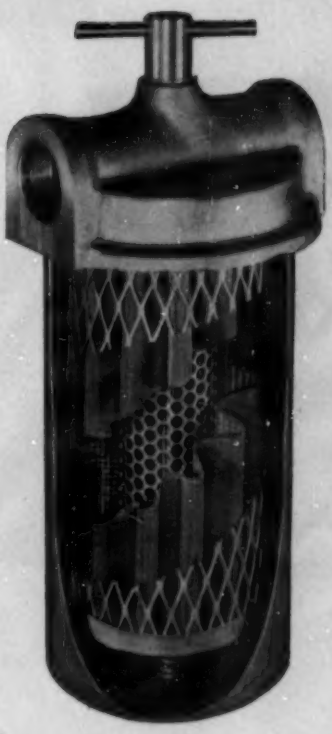
With a filter for the efficient filtration of all non-flammable hydraulic fluids, Marvel Engineering Company is again setting the pace.

By maintaining the accepted, Balanced Synclinal Design in this most recent development, all of the outstanding benefits that have won overwhelming preference for MARVEL SYNCLINAL FILTERS for use in all hydraulic and low pressure circulating systems have been retained.

Meet J.I.C. Standards

IMMEDIATE DELIVERY!

Now, as in the past, Marvel offers immediate delivery.



LINE TYPE
(Cutaway)

Write, or use coupon to obtain complete data.

MARVEL *Engineering Company*

Meets J. I. C. Standards

635 WEST JACKSON BLVD., CHICAGO 6, ILLINOIS
Phone Franklin 2-4431

Marvel Engineering Company, AH-9
635 W. Jackson Blvd., Chicago 6, Ill.

Gentlemen: Without obligation, please send me complete data on Marvel Synclinal Filters, as follows—

☐ Catalog #106 for Oil Filters ☐ Catalog #300 for Water Filters
☐ Data on Filters for Non-flammable Hydraulics Fluids

Name _____

Company _____

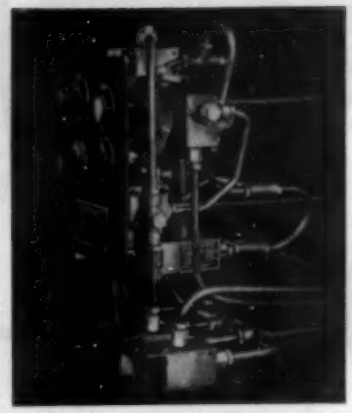
Address _____

City _____ State _____

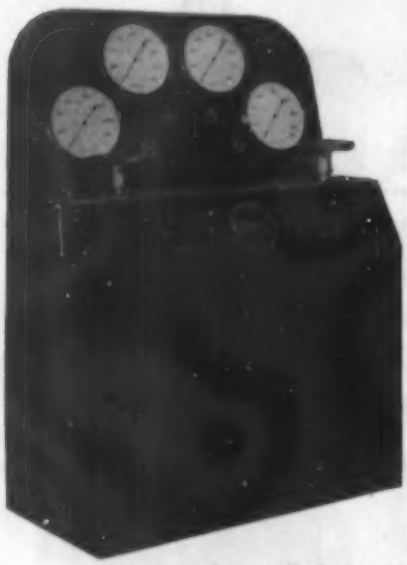
"Fingertip-control" OF HYDRAULIC PRESSURE

WITHOUT SOLENOIDS OR OTHER ELECTRICAL GADGETS

Packaged Unit comprising 22 h.p. motor mounting two Axial Plunger pumps, supply tank and control panel, operating pre-stressed concrete machine.



Fully hydraulic push-button control panel for a 100 ton Cartridge Case Drawing Press.



Control Desk for 500/500 ton Downstroking, Prefilling Press.

Any desired pressure is "at your fingertips" when operating the Autodraulic Control System —and without solenoids! Already giving consistent and unfailing performance throughout N. America in a wide variety of applications, the Autodraulic Control System cannot fail to give increased performance and greater economy in *your* plant.

AUTODRAULIC
CONTROL SYSTEMS

WITH HYDRAULIC PUSH BUTTONS

TOWLER BROTHERS (PATENTS) LTD. • RODLEY, NR. LEEDS • ENGLAND

Sole Agents U.S.A. and CANADA

MACMILLIN ENGINEERING CORPORATION
2125 HOWARD STREET, CHICAGO 45, ILLINOIS
Ambassador 2-1191

TR. 41

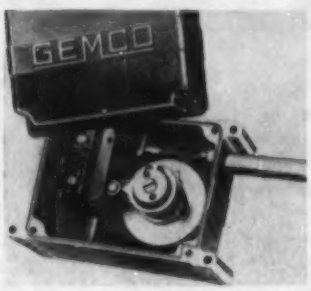
New Products

Continued

ROTARY LIMIT SWITCH
. . . for automatic control

Size: ½ pipe thread for conduit connections

Design: Selection of gear ratios, plus positive locking cams assures an unlimited control of the movement between any two limits. Gears are fabricated of highest quality bronze and steel supported by oilite bearings. ½ in hardened steel drive shaft extends beyond the case for easy linkage to the motive force.



Construction: The enclosure is of durable, molded fibraloy, a special fibre-glass alloy that is resistant to shocks, solutions of acids, alcohols, hydro-carbons and heat. Electrical circuit has two cam operated limit switches supplying one open and one closed circuit for each travel position.

Applications: Intended for reversing movement between two limits such as the opening and closing of electrically operated doors, windows, large valves, machinery. The switch works as an automatic control.

Gemco Electric,
Detroit 19, Mich.

Circle 205 on Reader Service Card

LARGE HIGH PRESSURE VALVES
. . . electrically operated

Size: ⅝ in to 4 in

Design: For use on large press hydraulic systems to handle the high rate of flow required at high pressures up to 6000 psi. Combinations handling 9500 gpm have been developed. Valves are of balanced design permitting easy manual operation, however, the development

Qualifying for use on Air Force and Navy aircraft, this 3,000 lb. MIL-AN-6248 hydraulic hand pump, manufactured by GLADDEN PRODUCTS CORP., 635 W. Colorado, Glendale 4, Calif. underwent a test of 70,000 full cycles—only one change of "O"-Rings was allowed, and volumetric efficiency had to stay at not less than 75%. *The pump, however, equipped with Parco "O"-Rings, finished the rigorous test with a remarkable efficiency rating of 97.8%—with no change of "O"-Rings!* Another example of the extra durability of Parco "O"-Rings—it pays off in better products, greater efficiency and lower costs! All dash numbers of AN 6227, AN 6230, AN 6290, MS 29512 and MS 29513 series for commercial or Army-Navy installations to Specifications MIL-P-5516A, MIL-G-5510A and MIL-P-5315A are available from stock. Silastics and other special compounds supplied on order.

New 8-page catalog and engineering data on request. Write us today.

Parco

PLASTIC AND RUBBER PRODUCTS CO.

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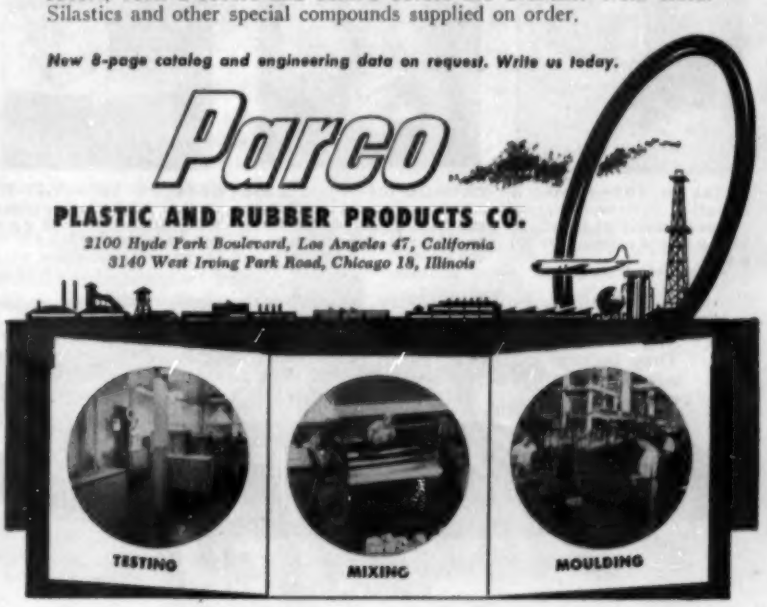


Circle 95 on Reader Service Card

ANSWERS TO YOUR PUMP PROBLEMS

These New TUTHILL Catalogs Give You Complete Data on Pumps for LUBRICATION, HYDRAULIC, COOLANT, TRANSFER and BURNING OILS SERVICE.

CATALOG 101—(Model L Series) Mechanically-sealed pumps in capacities from ½ to 6 g.p.m. and pressures to 600 p.s.i.

CATALOG 102—(Model C Series) General purpose pumps in capacities from 2 to 200 g.p.m. and pressures to 100 p.s.i.

CATALOG 103—(Model CK Series) High pressure pumps in capacities from 5 to 200 g.p.m. and pressures to 400 p.s.i.

CATALOG 104—(Model M Series) Coolant pumps with automatic internal by-pass. Capacities from 2 to 50 g.p.m. and pressures to 15 p.s.i.

CATALOG 105—(Model R Series) Automatic reversing pumps in capacities from ¾ to 200 g.p.m. and pressures to 100 p.s.i.

CATALOG 106—(Types S and SA) Stripped pumps for built-in applications. Capacities from ½ to 200 g.p.m. and pressures to 100 p.s.i.

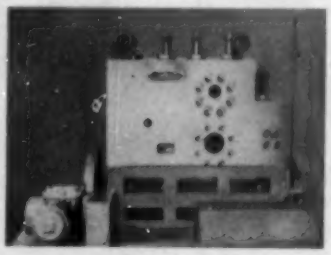
CATALOG 107—(Type SU) Multiple V-belt pumping units in capacities from 2 to 50 g.p.m. and pressures to 300 p.s.i.

Tuthill pumps are of the rotary, internal-gear, positive displacement type.
Any one or more of these Tuthill catalogs are available on request. They include individual pump guides to help you select the Tuthill pump best-suited to your requirements. Please ask for catalogs by number.

TUTHILL PUMP COMPANY
Dependable Rotary Pumps since 1927
939 East 95th Street, Chicago 19, Illinois

Canadian Affiliate—Ingersoll Machine & Tool Co., Ltd.
Ingersoll, Ontario, Canada

featured on these valves is the addition of motor operators. This arrangement permits remote operation of the valves from a central control console and in addition, permits interlocking a wide range of press functions and the introduction of semi or full automatic press



cycles. Motor operator powers the cam shaft which produces the valve lift in the required sequence. Control of the motor operator is achieved through a servo selsyn system, allowing for very fine remote control of the angular displacement of the cam shaft. A cam type limit switch of the multi-pole type permits the introduction of interlock or program controlling into the electrical circuit.

Lombard Corporation,
Youngstown 1, Ohio
Circle 206 on Reader Service Card

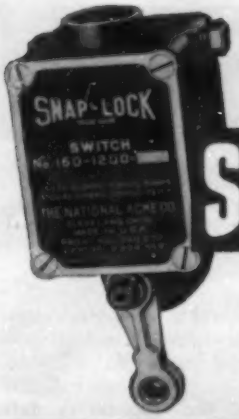
FILTER ELEMENTS . . . for aircraft service

Size: Rated to handle .5 gpm, 3 gpm, 6 gpm and 12 gpm of oil.
Design: Porous stainless steel filter elements for airborne high temperature hydraulic oil service. Material is type 316 stainless steel and may be used at

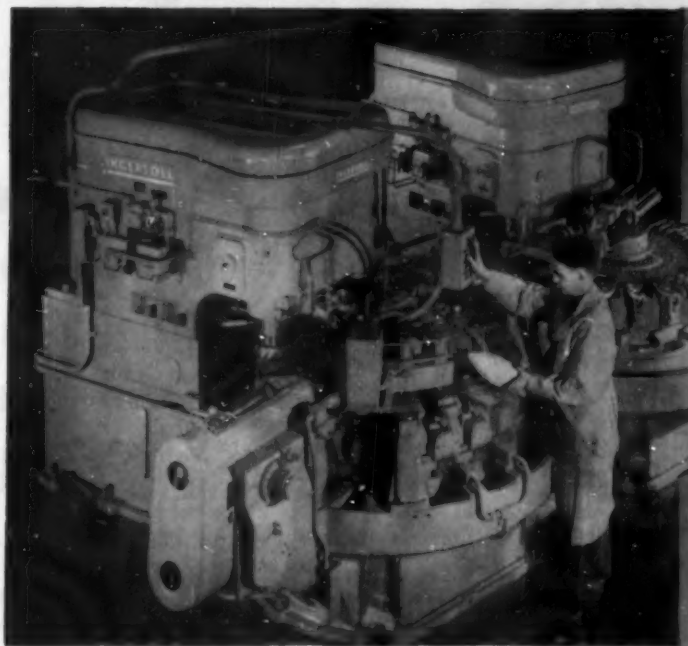
temperatures in excess of 600 F. These filter elements remove 2, 3, 7, 12 or 22 micron size particles. Pressure drops are low and adequate filter surface is provided, for long service life.

Aircraft Porous Media, Inc.,
Glen Cove, New York
Circle 207 on Reader Service Card

Continued on page 102



SNAP-LOCK TRADE MARK plays a vital part in new plant-automation plans



TWO COMPARTMENTS
sealed off—self-protected

ELECTRICAL SIDE

Accessible wiring connections, self wiping coin silver contacts, no arcing, heavy insulation throughout, oil and dust resistant case. Single pole, double break, double throw —positive lock in ON or OFF position.

MECHANICAL SIDE

Hardened steel parts, strong spring, rugged, compact construction, wide choice of operating levers. Snap-Lock is guaranteed mechanically and electrically for any normal circuit application.

Snap-Lock is the heavy duty limit switch—quick acting, positive, dependable—built *by* machine tool builders *for* machine tool builders.

In the 15 years since we first designed Snap-Lock to meet our own machine tool needs, it has been adopted as the standard switch equipment by 4 out of 5 of all builders of precision operated machine tools. Hundreds of users of other types of equipment also specify Snap-Locks—where control is vital, where lasting and service-free life is more important than mere price.

If you have a switch problem, choose from the wide variety of Snap-Lock standard types with regular or special mountings or, if you need a special application, let our engineers help you design Snap-Lock into your product.

Ask for Engineering Bulletin EM-51

INGERSOLL says:

"For this special model, again we rely on 13 Snap-Lock switches to insure correct sequencing of all 6 operations for automatic milling of tops, bottoms and sides of sole plates for electric flat irons at 1000 per hour-- fastest rate ever attained."

The Ingersoll Milling Machine Co. at Rockford, Ill., top flight builders of precision automatic milling, boring and drilling machines, have for years standardized on Snap-Lock limit switches.

ELECTRICAL MANUFACTURING DIVISION

The NATIONAL ACME COMPANY

170 EAST 131st STREET • CLEVELAND 8, OHIO

ACME-GRIDLEY
BAR and CHUCKING AUTOMATICS
1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • Limit, Motor Starter and Control Station Switches • Solenoids • Contract Manufacturing

SOLVED

weighing and testing problems by

EMERY force-measuring systems

Emery load cells offer the fundamental solution to *any* force-measuring or weighing problem.

Operating on simple, basic physical principles, Emery systems are maintenance-free. Some units have been in service over 25 years without even recalibration!

RANGES: 0 - 10,000,000 pounds . . . **ACCURACY:** 1/10 of 1% of range . . . **RESPONSE:** less than ½ second . . . **TYPES:** self-contained hydraulic, open-flow hydraulic, pneumatic . . . **CELL DEFLECTION:** less than 0.005" . . . **APPLICATIONS:** Weighing, Jet Engine Thrust, Brake Testing, Torque Measurements, Strength of Materials, Process Control, Tank Weighing, Platform Scales, Etc.

Since 1872, Emery Force-Measurement Systems have been lowest in initial cost, in operating cost, and require no maintenance.

Write today for information on stock or specially designed systems to solve your force-measuring problems.

THE A. H. EMERY COMPANY, NEW CANAAN 9, CONN.

Please send me
☐ Literature on hydraulic weighing
☐ Literature on pneumatic weighing
NAME _____
POSITION _____
Attach to, or write on, your company letterhead.

For more information circle numbers on the reader service card bound in this issue on page 109.

To help you solve sealing problems on hydraulic cylinders and reciprocating pumps, Darling Valve & Manufacturing Co. offers two bulletins. Dimensional and application data on cup type **packings** is presented.
Circle 27 on Reader Service Card

C. B. Hunt & Son, Inc., are offering Bulletin 531, which gives full details on their **hydraulic valves,** including pilot and solenoid operated types.
Circle 58 on Reader Service Card

If you are looking for a hydraulic pump which will deliver .4 gpm, you can get information on the Gerotor **internal gear pumps.** Standard fixed displacement models delivering from .4 to 40 gpm at 1500 psi are available.
Circle 47 on Reader Service Card

Small iron particles in your hydraulic oil can cause valve failure and machine downtime. To learn how you can eliminate this oil contaminant get a copy of Bulletin PM-65 which describes the **magnetic filters** made by S. G. Frantz Co., Inc.
Circle 40 on Reader Service Card

Have an application for **hydraulic hose?** Flex-O-Tube Division of Meridan Corporation offers an aircraft and industrial catalog which provides full information on hose, hose assemblies and reusable hose fittings.
Circle 38 on Reader Service Card

For the design of your fast cycling automatic air and oil machines, you'll want information on Beckett-Harcum's new **valves.** Their seal is by precision fit. On solenoid valves, coils can be removed without disturbing the electrical circuit.
Circle 16 on Reader Service Card

Circle 37 on Reader Service Card

Circle 88 on Reader Service Card →

Electronic spacer patterns guide stockpile through sequence of cuts automatically. Responsive Oilgear Transmission provides speedy travel with pin-point stopping within 3/1000ths of an inch from zero tolerance. Lawson Cutter also used in repetitive single cuts and for trim on sides. Photo in plant of Liedtke Brothers, Chicago.

The RESULT?

Accuracy just 900% better

Production increase 50 to 500%

Over and over and over again, Oilgear Fluid Power proves to be the right solution to a drive problem. Take the case of the Lawson Cutter.

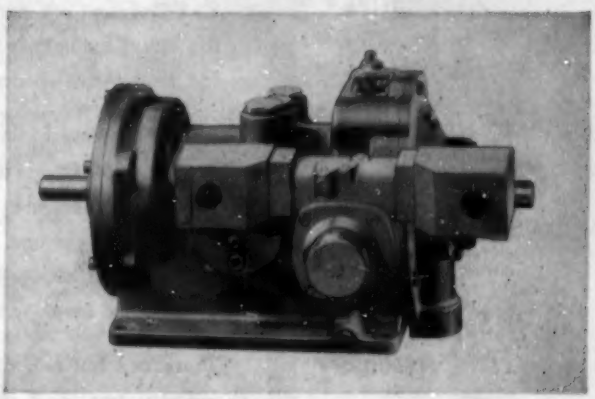
If precision is emphasized anywhere, that "where" is the field of fine color printing of every description. Money, time, effort are spent that art be right, that plates be right, that printing be right—to a hairline. And then comes the cutting operation where all that has gone before is saved—or wasted. Small wonder that cutting remained a hand operation for many years.

But the E. P. Lawson Company, manufacturer of cutting machines, wanted to modernize and mechanize the operation. Its designers turned to an electronic spacer device. This if anything would give precision in marking *where* to cut. But the next problem was to find a power drive capable of *obeying* the orders the electronic signal system was capable of *giving*. Lawson tried one type of drive. It varied all over the map. Lawson tried another type of drive. It was fairly accurate —but did not hold up.

Finally, as so many machine designers have done, Lawson turned to Oilgear. And there, as so many machine designers have done, Lawson found the answer to its problem.

The answer? Undeviating accuracy within 3/1000ths of an inch from zero tolerance—just 900% better than what had been achieved in the past; speed, translating into production increases of 50% to 500% month in and month out. How? Through the absolute responsiveness of Oilgear Fluid Power Drive to the automatic control system. Immediate, shockless acceleration to full speed "forward". Precise measured slowdown as the feed fence nears the target. Precision stopping "on target" for the cut and then rapid acceleration toward the next cut.

Here again is an example of the superlative "right-



Oilgear Two way Variable Speed Transmission as used on Lawson Electronic Spacer Cutters. These drives also provide unlimited speed range from zero to maximum. Speed changes made in split second or specified time.

ness" of Oilgear Fluid Power "generators," motors, transmissions—for almost any type of installation or machine requirement, big, little, and all those in between.

Chances are Oilgear is *the* solution you've been looking for. And Oilgear engineers will be just as quick to tell you if Oilgear is *not* for you. Ask for further information from an Oilgear Engineering Representative. No charge. No obligation. THE OILGEAR COMPANY, 1564 W. Pierce St., Milwaukee 4, Wisconsin.

OILGEAR

OILGEAR

put the pressure on FLEX-O-TUBE®

If pressure is a factor in the performance of your product, you can rely on Flex-O-Tube. For here is a name that has stood for uniformity of high quality for twenty-five years.

And just as important, the Flex-O-Tube organization is one that you can rely on, too. When the pressure's on for production you can count on prompt deliveries of flexible hose products that consistently meet specifications.

These are but two of the reasons why industry has used miles and miles of Flex-O-Tube and continues to specify it in increasing quantities. Why don't you find out for yourself by "putting the pressure on Flex-O-Tube"?

Supplied in Assemblies

Flex-O-Tube will help you determine the assembly needed or work to your own specifications. In either case, modern facilities and latest inspection techniques assure you a uniformly high quality product delivered promptly.

Supplied for Field Assembly

Flex-O-Tube hose is also supplied in bulk coils with reusable fittings for field assembly. Complete range of sizes and types.

Please send me your free ☐ aircraft catalog. ☐ industrial catalog.

Name .....

Company .....

City ..... Zone ..... State .....

Address .....

FLEX-O-TUBE

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Free Literature Offered in this Month's Ads

Continued

Cylinders for oil pressures to 750 psi and air to 200 psi are described in Bulletin SM-454-2 offered by Tomkins-Johnson. The new compact design of these cylinders saves up to 40 percent of the space normally required.

Circle 116 on Reader Service Card

"O" ring data, including engineering, design, and compound information, gland groove and back-up ring requirements, is available from National Motor Bearing Co., Inc.

Circle 85 on Reader Service Card

Designing with **"O" rings** for hydraulic and pneumatic packings saves space and reduces cost. Application suggestions are included in Precision Rubber Products Corp.'s "O" ring handbook.

Circle 97 on Reader Service Card

Facts on heavy duty **hose** and reusable **couplings** are presented in Catalog H-1451, released by The Weatherhead Company.

Circle 127 on Reader Service Card

Power for many clamping and pressing jobs can be economically supplied by an air operated hydraulic **booster.** Miller Fluid Power Company's Bulletin B-200 gives you information on sizes, uses and installation.

Circle 80 on Reader Service Card

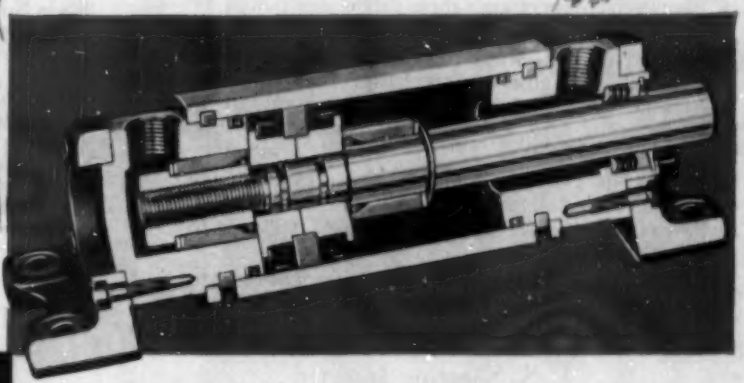
Production can be stepped up by designing air powered dial feed **index tables** into your tooling. The A. K. Allen Co. offers literature on their tables and cylinders.

Circle 6 on Reader Service Card

Sprague Engineering and Sales Corp. offers bulletins describing their **air driven pumps** which will develop up to 30,000 psi. They can be used for water or oil. These pumps meet the needs of low volume output at high pressures.

Circle 107 on Reader Service Card

BUILT TO LAST...



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Style No. P-2138—*Neoprene cover,* with sheeting insertion, in 36" width only, 1/32" thick and up.

Style No. P-2335—*Buna N cover* with special sheeting insertion. 36" wide, 1/32" thick and up.

Style No. P-2901—*Neoprene cover* with sheeting insertion, recommended for handling oils and solvents; 36" wide, 1/32" thick and up.

Style No. P-2139—*crude rubber cover* with extra-heavy duck insertion, 1/8" thick and up.

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Style No. P-2904—*Neoprene cover.* General service diaphragm sheet. Supplied in 40" widths of 1/16", 1/8", 3/16" and 1/4" thicknesses.

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recommended for high pressures

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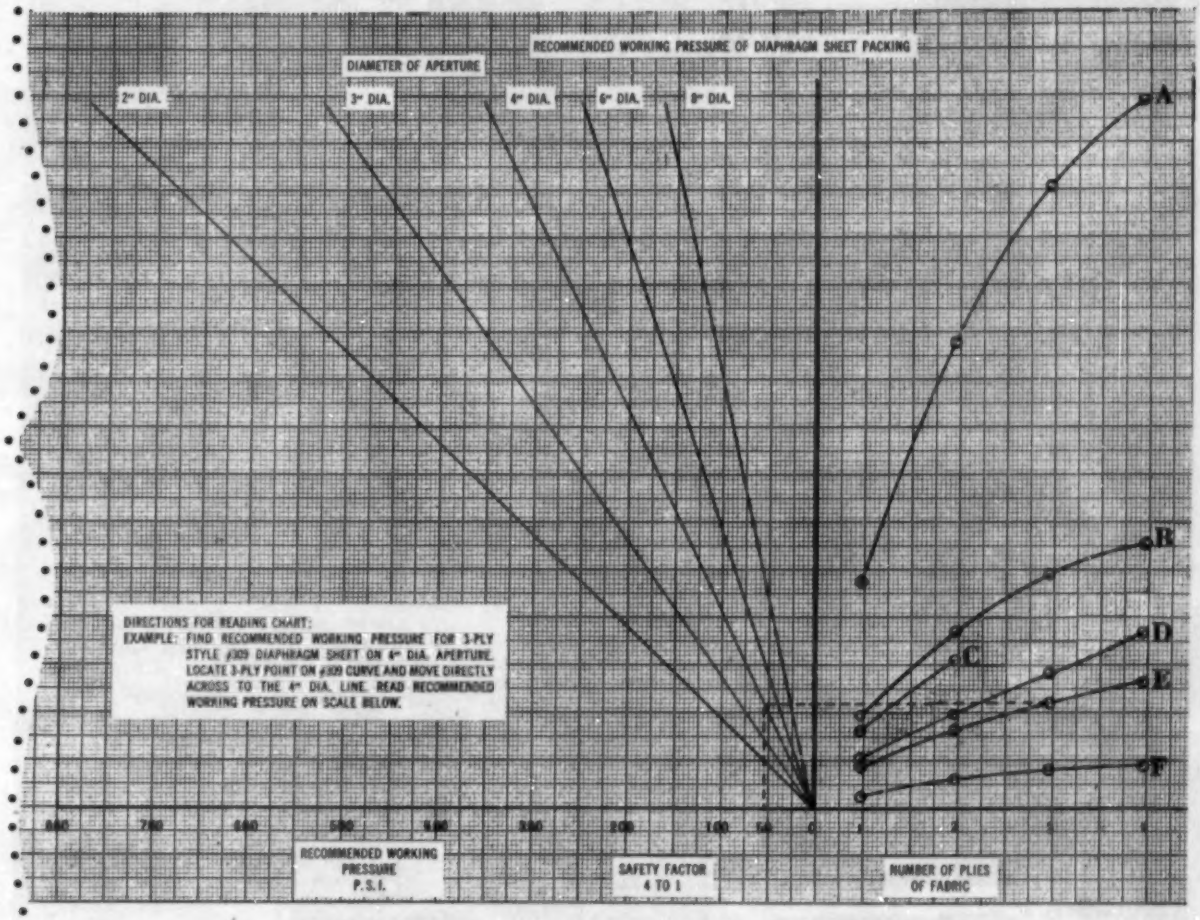
RECOMMENDED WORKING PRESSURE OF DIAPHRAGM SHEET PACKING
DIAMETER OF APERTURE
2" DIA.
3" DIA.
4" DIA.
6" DIA.
8" DIA.
A
B
C
D
E
F
DIRECTIONS FOR READING CHART:
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RECOMMENDED WORKING PRESSURE P.S.I.
SAFETY FACTOR 4 TO 1
NUMBER OF PLIES OF FABRIC

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C. NYLON-P-2339 (CRUDE RUBBER) P-2341 (BUNA N) P-2905 (NEOPRENE)

D. COTTON-#509 (CRUDE RUBBER) P-2133 (NEOPRENE)

E. COTTON-#309 (CRUDE RUBBER) P-2135 (NEOPRENE)

F. COTTON-P-2136 (CRUDE RUBBER) P-2138 (NEOPRENE) 1516-F (CRUDE RUBBER) P-2335 (BUNA N) P-2901 (NEOPRENE)

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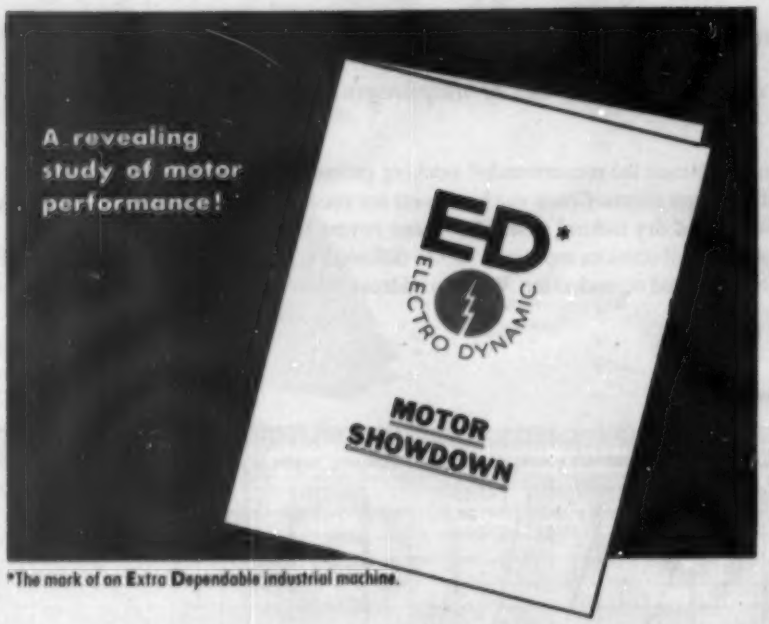

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Free Literature Offered in this Month's Ads

Continued

Tandem valves for manually controlling several oil powered operations on industrial or mobile applications are described in literature offered by Gresen Manufacturing Company.

Circle 52 on Reader Service Card

Graton & Knight Co. are offering a **packing** catalog and manual 201-A. Contains 60 pages of up-to-date data which includes the latest J.I.C. recommendations for cups, flanges, U's, V's, O-rings and oil seals.

Circle 49 on Reader Service Card

Rugged, heavy duty **valves** for pressures up to 5000 psi and for handling air, water or oil systems—using 1/8 to 2-1/2 inch piping are described in a catalog prepared by W. H. Nicholson & Co.

Circle 87 on Reader Service Card

Proper **tubing** can make the difference between good or bad hydraulic design. Data from Avon Tube Division, Higbie Manufacturing Co., will assist you in "tubing up" your circuit.

Circle 14 on Reader Service Card

For information which will help you solve your oil filtration problems ask for U.S. Hoffman Company's Bulletin A-974 and A-916. Both portable and stationary **filters** complete with pump and motor for circulating hydraulic oil are described.

Circle 120 on Reader Service Card

If you drive your hydraulic pump through a belt drive, you will want information on **pulleys.** Lovejoy Flexible Coupling Company offers a bulletin which describes their variable speed pulleys.

Circle 75 on Reader Service Card

One place where you can reduce your hydraulic circuit problems is at the relief valve. If you require an in-line direct acting **relief valve** that will not leak and has tamper-proof adjustment, write for information about the James-Pond-Clark 5100 series valves.

Circle 63 on Reader Service Card

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Eastern designing and engineering skill in helping you choose a pump or fluid motor rests on one all-important standard — to recommend a unit that performs its job reliably, while keeping size and weight to a minimum. The result is an improved product — smaller, lighter, less expensive — and with equal or better performance.

For a catalog with helpful design information, product and engineering data, send for Eastern Bulletin J-950.

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204 MAIN STREET

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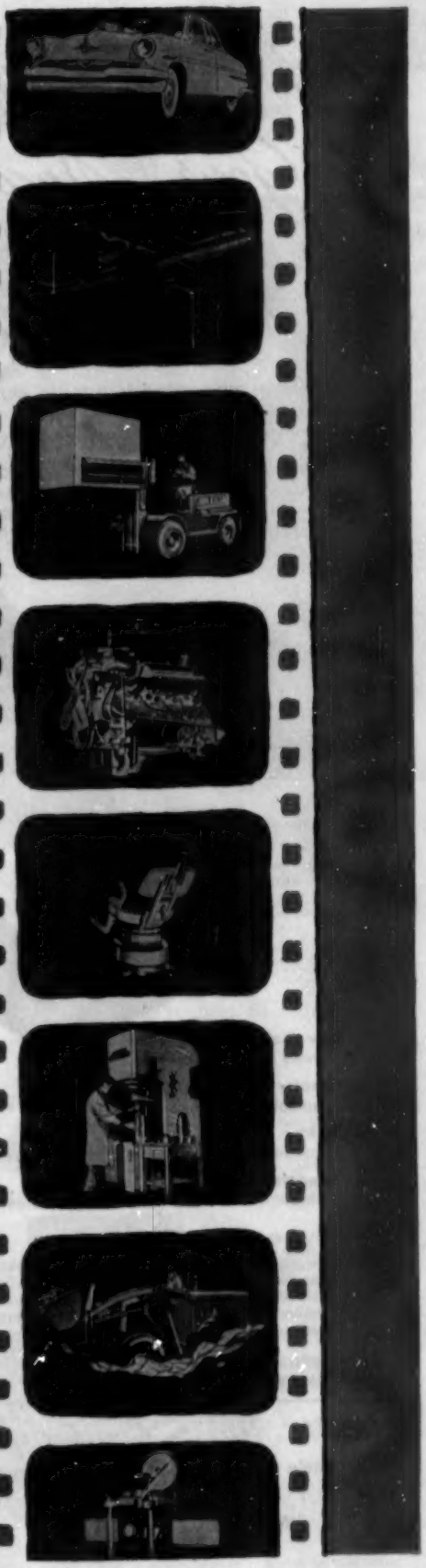

Circle 32 on Reader Service Card

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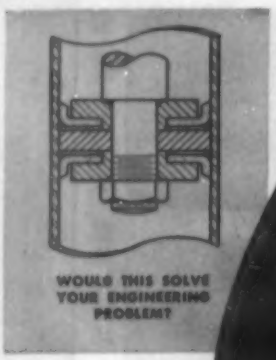

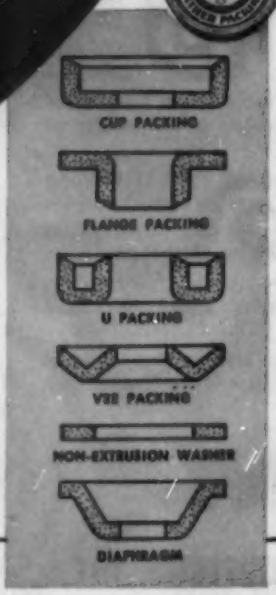

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Free Literature Offered in this Month's Ads

Continued

Reliability of air systems depends on clean, lubricated air. M-B Products Division of Tool Sales Co. has available literature on their **filter, regulator and lubricator** assembly which protects air powered circuits.

Circle 79 on Reader Service Card

Every hydraulic system should have the protection of an **oil filter** on the suction side of the pump. Dollinger Corporation sump filter with a radial fin insert is described in Bulletin HF-2.

Circle 30 on Reader Service Card

A new **pump** that will develop up to 30,000 psi, without auxiliary equipment is described in data sheet 36 in complete detail. Write to the Aldrich Pump Company. Pumps are available in low and high pressure models, single or double-acting.

Circle 5 on Reader Service Card

For bulletins about **flow controls** write to The Denison Engineering Company. Available in 2-port and 3-port types, with or without built-in check valves.

Circle 28 on Reader Service Card

A new "O" **ring** brochure, released by Goshen Rubber Co. Inc., is available. Contains 12 pages of information on sizes, groove dimensions and application data. To aid in obtaining efficient sealing for most every type of application.

Circle 48 on Reader Service Card

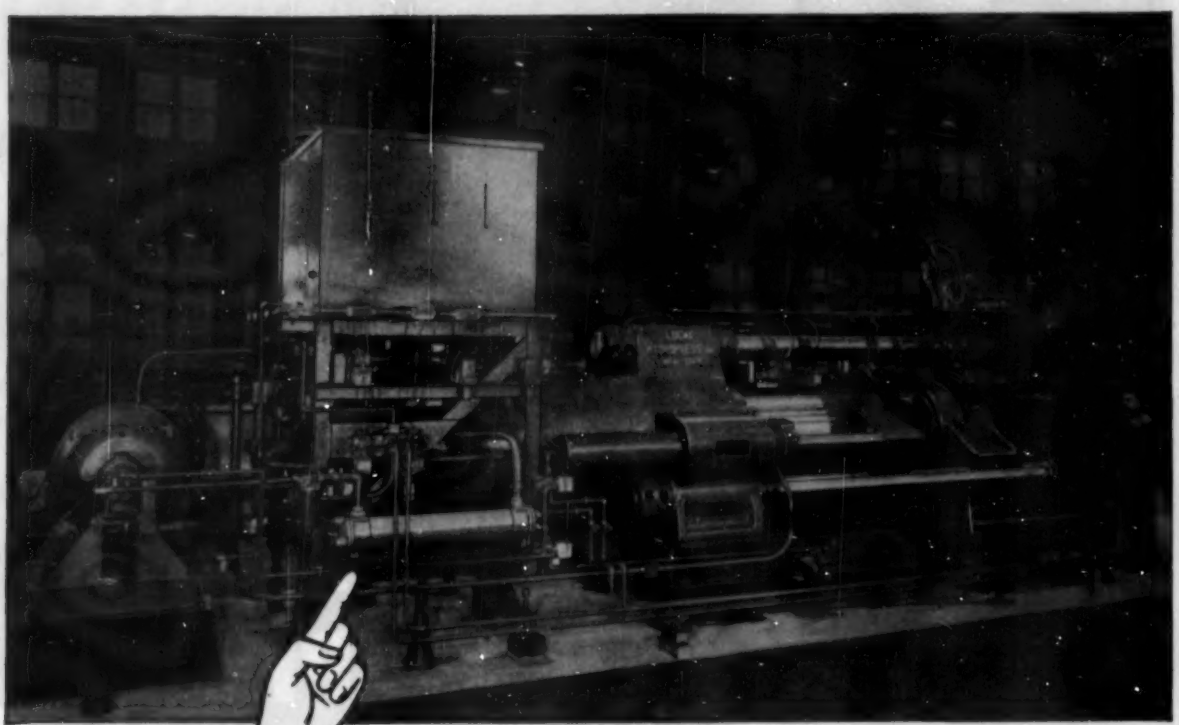
You may write Webster Electric for a catalog which contains illustrations, descriptions, performance charts and **pump** data sheets, on which you can submit your own requirements.

Circle 128 on Reader Service Card

Bulletin ESF-9, offered by Electro-Snap Switch & Mfg. Company, describes a one-way impulse switch, eliminating interlocking switches and speeding up automatic operation.

Circle 35 on Reader Service Card

Cooling Hydraulic Oil ...WHILE THIS 1250 TON LOEWY-HYDROPRESS OPERATES AT 28.5 IPM EXTRUSION SPEED



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Capable of producing a wide variety of structural and ornamental shapes in aluminum, this 1250-ton Loewy-Hydropress Extrusion Press is equipped to operate at 28.5 ipm extrusion speed.

To maintain peak pump capacity of 115 gpm at 2700 psi by preventing overheated, thinned oil, Hydropress, Inc. has equipped this press with a Ross Type BCF Exchanger. *Safe, dependable cooling, is assured!*

Regularly installed as integral components of numerous types and makes of hydraulic machinery, Ross Exchangers are not only top-rated for thermal efficiency, but they are ruggedly built to withstand punishing hydraulic shock. Tough, ductile, seamless shells and brass forgings can well absorb the extra load.

Pre-engineered and fully standardized in a wide range of sizes, Ross Type BCF Exchangers are available with "off-the-shelf" speed to meet most requirements.

For detailed information, request Bulletin 1.1K5.

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INGERSOLL process millers, typical of hydraulic machines that can best be protected by *Texaco Regal Oil R&O.*

THE "TRICK" OF KEEPING HYDRAULIC SYSTEMS CLEAN

NO sleight-of-hand required for this "trick" — just common sense. Use the oil that's made to prevent sludge, rust and foam—*Texaco Regal Oil R&O*. Then hydraulic systems stay clean, mechanisms run more smoothly, pumps and other parts last longer, maintenance costs come down.

Texaco Regal Oil R&O is the oil that tests prove has *more than ten times the oxidation resistance* of ordinary turbine-quality oils. This means freedom from sludge formation. Freedom from rust and foam is assured by special inhibiting additives.

There is a complete line of *Texaco Regal Oils R&O* to meet the requirements of all types and sizes of hydraulic mechanisms, and all conditions of service.

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FOR ALL HYDRAULIC UNITS

BUILT-IN AIR-HYDRAULIC JACKS

pay for themselves every time they're used

By George D. Becker

BUILDING hydraulic jacks into the large tapered joints of machines provides a ready means of opening the joint quickly and easily when accident or maintenance requires it. Commercially available components make the design simple and reliable. Compared to the cost of lost production, their cost is negligible.

Present day high production demands large sized, heavy duty machines. This is particularly true in mining low-grade ore. To meet this demand in mining iron, Allis-Chalmers Manufacturing Co. is building a gyratory crusher capable of crushing five foot cubes of Taconite to ten inch size at the rate of 3500 tons per hour.

Larger crushers would be built if it were not for the limitations of transportation and machine tools. These limits are strained to the utmost to produce this 1,250,000 pound giant, and kept the heaviest weight in one piece down to just over 100 tons.

This machine was quite a challenge to the designer. Although most of the design followed traditional and proven form where possible, much invention was necessary because of the great size and weight of the parts.

The main shaft assembly, the moving part that crushes the ore and the heaviest single unit, is supported on a hydraulic, adjustable step bearing similar to the "Hydrocone" gyratory crusher described in APPLIED HYDRAULICS December, 1952. Any other means for adjusting this part would be difficult and tedious because of the great weight involved.

When building these huge machines, the designer must avoid innovations as much as possible. Experiment on such a grand and costly scale is economically prohibitive. Some innovation, however, is always necessary.

One necessary invention concerned the means for opening the tapered press fit joint, Figure 1, where the spider or upper bearing rim (A) is attached to the top shell (B), the part surrounding the crushing chamber. These two parts require a rather heavy interference fit where they join because of the stress reversal from the gyratory motion.

Maintenance of the wearing parts in the crushing chamber requires that this joint be opened twice yearly, and on occasion, more often.

On smaller machines opening this joint is done, suitably, with a set of steel wedges and sledge hammers. On a machine of this huge size, hand power and wedges become futile.

Having pioneered hydraulic adjustment of crushers, it was natural for us to turn to an hydraulic means to solve this joint problem. For the wedges used on smaller sized crushers, we substituted eight small,

GEORGE D. BECKER, Product Engineer, Allis-Chalmers Manufacturing Co., Milwaukee 1, Wis.

For applying brute force, you can't beat hydraulics. The heavy members of this machine had to be separated at least twice a year. Permanently built-in jacks do the job and pay for themselves the first time they are used!

hydraulic pistons, Figure 2, around the 36 foot periphery of the joint. The pistons are fitted in cylinders drilled and reamed in the lower flange of the joint and opposed by the upper flange. This made a simple but powerful means for opening the joint.

For operating these pistons, we found several suitable makes of hydraulic pumps with boosters. These pumps can produce almost any reasonable pressure, so a small air-operated pump, capable of producing up to 30,000 psi, was selected. Air-operated because it would age less under the conditions, and 30,000 psi so that more power would be available than would ever be called for so as to forestall failure from lack of starting power, regardless of changing conditions of the joint, rust or extreme cold weather.

The pump is permanently piped in place with welded fittings and seamless tubing of iron pipe size. The volume of hydraulic fluid to be handled is small due to the small lift (¼ inch) the overhead crane taking over at this point. For this reason ¾ inch pipe was considered large enough.

A needle valve is installed at each cylinder so that individual or groups of pistons can be made inoperative if the rim tilts or sticks on one side.

Premature aging from idleness was a matter of considerable concern and led to the selection of a special packing, rust inhibiting oil as a hydraulic medium and the use of an air driven pump, rather than one driven by electric motor.

The piston is designed for leakproof operation at extreme pressures. To prevent mushrooming of the head, the piston is made of high carbon, heat-treated steel. The bore, centering the packing plate is one-half of the piston diameter, thus, when the pressure acts on the packing plate on one side, the unit pressure on the soft packing will be higher than the unit pressure on the oil. This is inversely as the difference of the area of the packing is from the area of the packing plate. In this design the pressure of the packing against the cylinder walls will at all times be 133 percent of the pressure of the oil. For this reason the oil cannot leak.

The packing is a solid ring of a commercially available mixture of Buna "N" rubber and vinyl plastic called "Enrup Rubber" which, it is hoped, will be practically ageless and oil proof. Its size is slightly more than the cylinder bore on the outside, and a little less than the diameter of the gudgeon on the packing plate, inside. The height is one-fourth of the diameter.

This is an old design originally used by Dr. P. W. Brigdman in experiments in sealing high pressure—See Scientific American Magazine July, 1927.

With a capacity of 3500 tons per hour, one-third of which is valuable concentrate selling for approximately $12.00 per ton, every hour used for maintenance costs $14,000 in lost production alone. This was quite sufficient to convince the operator of the value of this small hydraulic device. The few thousand dollars added to the cost of the crusher will be amply repaid at the first change of wearing parts.

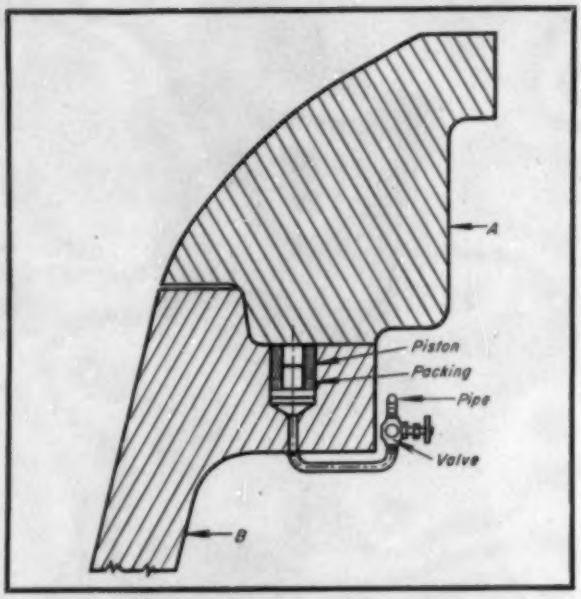

FIG. 1. DETAIL OF PRESS FIT tapered joint, where the upper bearing rim (A) is attached to the top shell (B).

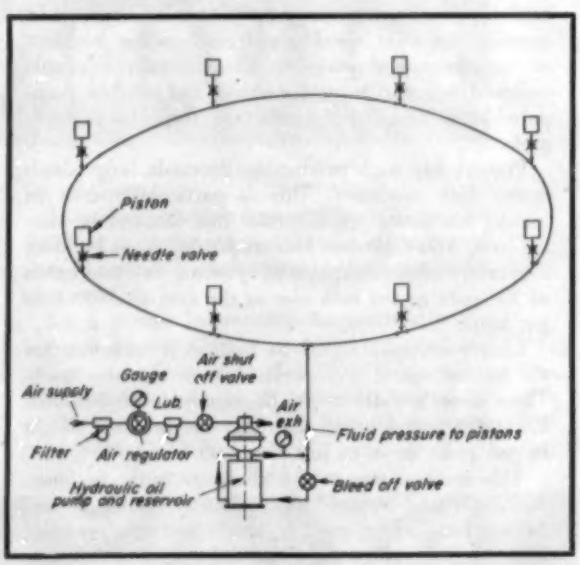

FIG. 2. AN AIR OPERATED hydraulic pump capable of developing 30,000 psi powers eight small hydraulic pistons which are located around the 36 foot periphery of the joint.

Register for the

National Conference on Industrial Hydraulics

PRE-REGISTRATION

National Conference on Industrial Hydraulics
Sheraton Hotel, Chicago, October 14, 15, 1954

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National Conference on Industrial Hydraulics
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**All registrants will receive Volume VIII, Proceedings of the Conference as soon as it becomes available. Proceedings will contain the complete text of all technical papers presented.*

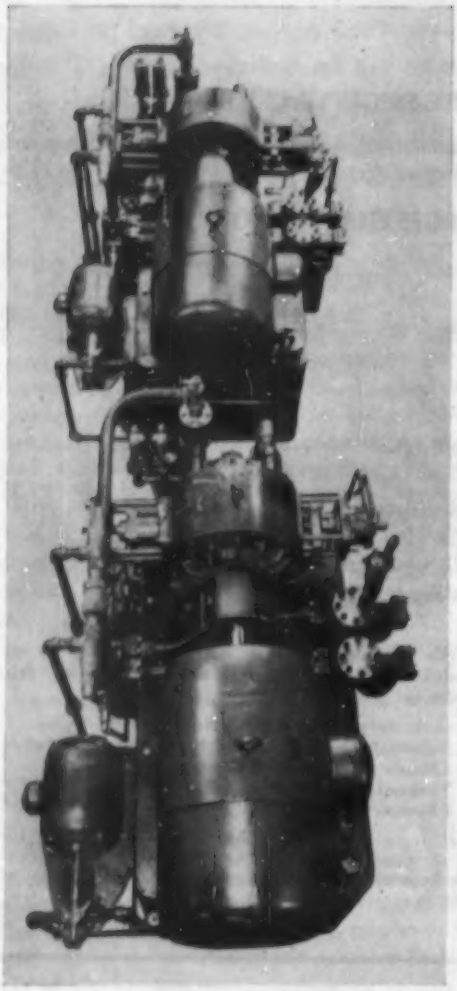
THE National Conference on Industrial Hydraulics will observe its tenth birthday and a decade of successful growth at its annual two day meeting at the Sheraton Hotel, Chicago, October 14 and 15.

In 1945 the sponsors, Illinois Institute of Technology and the Armour Research Foundation of Illinois Tech, organized the first session which proved so successful that plans were made to make it an annual affair. By 1953 more than 700 men registered to attend the ten technical sessions, luncheons and banquet. The meeting has become the outstanding annual meeting in industrial hydraulics.

Carl E. Schmitz, 1954 Conference Chairman, states that an outstanding program of twenty papers by specialists, has been arranged for the October meeting.

Since a record number of registrants are expected, it is suggested that early registration is advisable. The above form can be used to complete your registration for the conference.

TWO PUMP



THESE power packages, which supply oil to the cylinders, are connected electrically so that they operate simultaneously.

High pressure, low slip, radial piston pumps with a gear pump powered stroking mechanism supply equal volumes to each of the two car dumping jack cylinders. The circuit has safety and control features which are required by many oil powered machines.

THREE major design problems are solved in the construction of a hydraulic power system used to dump slag loaded railroad cars. Keeping two cylinders moving together regardless of varying loads, eliminating possibilities of shock in the system because of the large mass being handled, and providing rigid piping on oscillating cylinders are all accomplished in the design.

While these three considerations were of major importance, several other requirements had to be met. Protection against the outdoors and against dirt had to be provided. Operation had to be simple "up-down" pushbutton control properly interlocked for safety and efficient operation.

Synchronizing the motion of two cylinders is always a difficult problem. Rate of travel depends on the volume of oil delivered to a cylinder, and to move them together requires equal flow of oil to each cylinder. Leakage, pump slip, changing work loads and varying friction loads all affect oil delivery. On the car dumping system, uneven loading is almost inevitable, yet the jack cylinders must move together to prevent twisting of the car body.

ACCELERATION WITHOUT SHOCK

To assure synchronization of the jack cylinders, it was decided to power each one from a separate variable and reversible volume pump. The use of such pumps, in addition to offering high volumetric efficiency, allows the necessary incremental adjustment of the volume delivered in order to obtain synchronization.

The variable and reversible volume feature of the pumps offers the additional advantage of permitting smooth acceleration and deceleration of the cylinders without shock. This is accomplished in the following way.

Referring to the circuit drawing, the pumps are normally on negative or idle stroke so that the actual pressure port becomes a suction port and oil is pulled from the tank through the check valve, and circulates back to tank at zero pressure. Pressing the "up" button energizes solenoid A-1 in the main pilot valve,

L. ARTHUR LASSMAN, Benjamin Lassman & Son, Glenshaw, Pa.

By L. Arthur Lassman

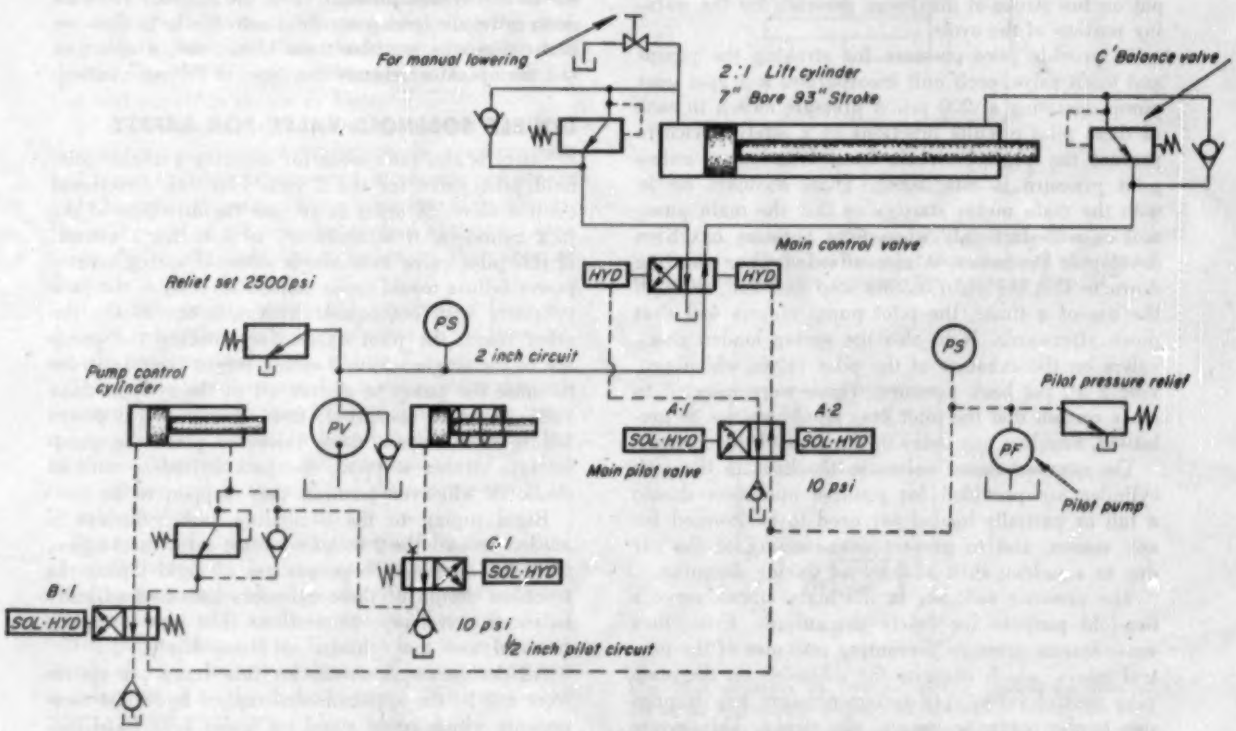
SYSTEM *provides synchronized motion*

and B-1 in the control valve for the double acting pump stroking cylinder. The 2 inch, four-way two position valve, which provides directional control of the cylinders, shifts to the "up" position; the pumps are stroked from full negative to full work stroke which builds up the oil delivery slowly to accelerate the car. Releasing the button deenergizes B-1, but not A-1, and the pump is stroked back to negative or idle position, decelerating the car to a stop.

To lower the car, which operation was to be carried out at the same speed as dumping, it is obvious that the pumps would have to be placed on something less than full stroke, for they are now delivering to the rod end of the cylinders. As a result of some other considerations, the rod end area was finally set at one half the total piston area, thus calling for the pumps to be placed on only half working stroke for lowering. Actual volumetric capacities of the pumps is 44 gpm.

With the pumps on idle stroke after dumping, the "down" button is pushed energizing A-2, B-1, and C-1. The main 2 inch, four way directional control valve now shifts to the "down" position with the

HYDRAULIC CIRCUIT, shown for one of the jack cylinders, uses a variable volume high pressure pump for power. A small gear pump supplies pilot pressure to control pump delivery and to operate the control valves.



pumps once again being stroked from full negative to work stroke for accelerating the car. However, in this case a second stroke positioning cylinder is brought into play through pilot valve C-1, which has been energized, so that the pumps can move only to half working stroke.

NO VALVE REVERSAL UNDER PRESSURE

When the car is completely lowered, the jack cylinders have additional stroke which allows the hooks on the rods to engage the cam pedestals so that the cylinders are pivoted away from the track to provide adequate clearance for the locomotive and cars.

Releasing the "down" button deenergizes A-2, B-1 and C-1, returning the pumps to idle position.

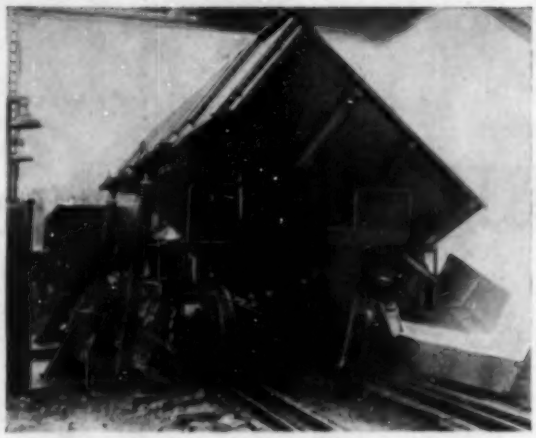
It can be seen, then, that the main 2 inch, four-way valve never reverses under pressure, because the pumps are put on delivery stroke only when the "up" or "down" button is contacted. In this way, hydraulic shock of flow reversal is prevented.

It is interesting to note that the action of the variable volume pumps in this circuit is different from the usual variable volume circuits. Most such circuits use a variable volume pump to give large volume, low pressure rapid advance, and then as pressure builds up the pump shifts to a short stroke, low volume high pressure position. During idling, the pump is by-passed to circulate at zero pressure. In the dump car circuit, the pumps are stroked in reverse for idling and are put on full stroke at maximum pressure for the working portion of the cycle.

To provide pilot pressure for stroking the pumps and main valve, each unit incorporates a 3 gpm gear pump operating at 200 psi. A pressure switch in each of these pilot circuits functions as a safety device to prevent the control circuit from functioning unless pilot pressure is established. These switches tie in with the main motor starters so that the main pump motors will start only when pilot pressure has been developed. Protection is also afforded when shutting down in that the main motors stop first and, through the use of a timer, the pilot pump motors will shut down afterwards. Note also the spring loaded check valves on the exhausts of the pilot valves which provide a 10 psi back pressure. These were inserted to make certain that the pilot lines would always be preloaded, avoiding any delay in response of the controls.

The counterbalance valves in the lines to the jack cylinder are provided for positive operation should a full or partially loaded car need to be lowered for any reason, and to prevent over-running of the car due to a sudden shift of the load during dumping.

The pressure switches in the main circuit serve a two-fold purpose for safety precautions. First, they sense system pressure preventing response of the control relays, which energize the solenoids on the main pilot control valve, until system pressure has dropped due to the pumps going on idle stroke. This means that release of the "up" button and immediate contacting of the "down" button will not reverse the direction of the car until the system pressure has dropped to a value low enough to prevent shock; only then will the main four-way valve reverse and the pumps return to delivery stroke.



TWO CYLINDERS, each powered by a separate hydraulic circuit, raise this car to dump a load of slag.

Secondly, should the operator fail to release either the "up" or "down" button when the cylinders have reached the end of their stroke, the pumps would normally maintain the maximum pressure of 2500 psi, delivering through the relief valves provided on the unit. However, to prevent this unnecessary waste of power, when the cylinders reach either end of their stroke and system pressure rises, the pressure switches deenergize the pump stroke control pilot valves so that the pumps are placed on idle stroke, whether or not the operator releases the "up" or "down" button.

DOUBLE SOLENOID VALVE FOR SAFETY

Safety is also the reason for selecting a double solenoid pilot valve for the 2 inch four-way directional control valve. In order to reverse the direction of the jack cylinders, it is necessary to energize a circuit. If this pilot valve were single solenoid spring return, power failure would cause sudden reversal of the jack cylinders with consequent hydraulic shock. On the other hand, the pilot valves for stroking the pump are of the single solenoid spring return type. In order to cause the pump to deliver oil to the system, these valves must be energized; thus, any electrical power failure would cause these valves to place the pump on idle stroke, stopping the jack cylinders without shock in whatever position they happen to be.

Rigid piping to the oscillating jack cylinders is needed because the 2 inch lines must carry the 44 gpm, 2500 psi oil flow. To permit use of rigid piping the trunnion design of these cylinders uses hydraulically balanced swivel pipe connections. The pipe is rigidly fastened and the cylinder oscillates freely.

All design requirements for this dump car system were met by the application of rugged hydraulic components which could stand up under long hard outdoor operation.

HYDRAULICS BASIC ARTICLE

DIFFERENTIAL CIRCUITS

● By James Tankard

WHAT is a differential circuit and why is it used? A circuit in which the exhaust oil from the rod end of a cylinder is directed back into the pressure line is called a differential circuit. Its purpose is speed control of a reciprocating piston. A simple differential circuit is shown in Figure 1.

To understand the differential circuit, we must first thoroughly understand the difference between pressure and force. Pressure is measured in pounds per square inch, hereafter called psi. Force is measured in pounds. Force is equal to the pressure applied against an area times the number of square inches in that area as shown in Figure 2.

If we introduce a piston rod, protruding from the cylinder, whose area is not acted upon by the pressure, we will have unequal areas, Figure 3.

The volume of oil required to move a piston through one stroke is equal to the piston or annulus area times the length of the stroke. In Figure 3, the stroke being 10 inches, the volume in the head end would be 100 cubic inches, and in the rod end the volume would be 50 cubic inches.

The speed of a piston is determined by the volume of oil delivered by a pump each minute (gpm) divided by the volume of oil necessary to move the piston through one stroke, as illustrated in Figure 4.

The point illustrated by Figure 4 is true only of the simple circuit, where the exhaust oil from the rod end is being piped to the tank. Figure 5 illustrates what

JAMES TANKARD, Design Engineer, Zagar Tool, Inc., Cleveland, Ohio

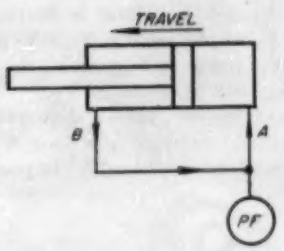


Fig. 1. As pressure oil from pump flows through line "A" moving piston, exhaust oil from rod end of cylinder is directed back into pressure line through line "B".

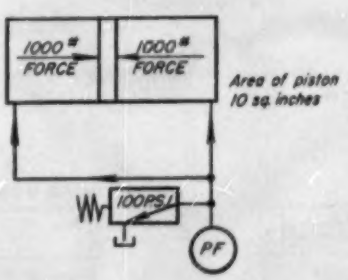


Fig. 2. A pressure of 100 psi acting against an area of 10 sq in will create a force of 1000 lbs. Since the area of the piston is the same on both sides, the force is also equal and the piston will not move.

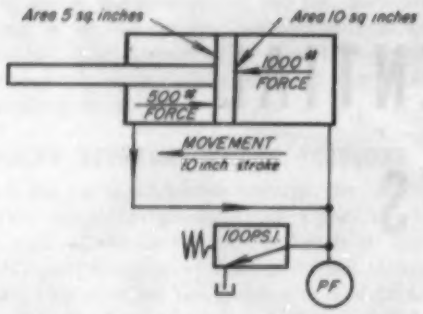


Fig. 3. The 5 sq in area is called the annulus area and is equal to the piston area minus the rod area. The pressure is the same on each side of the piston, but the forces are unequal and the piston will move in the direction of the greater force.

happens in a differential circuit where the exhaust oil is piped back into the pressure line.

When the piston moves from Position "X" to Position "Y" the volume of oil in the rod end is transferred to the head end of the cylinder.

If we designate the volume in the head end (Position "Y") as V_1 and the volume in the rod end (Position "X") as V_2 we can see that $V_1 = V_2$ plus some oil delivered by the pump or conversely, the oil required from the pump will be equal to $V_1 - V_2$. Since we know how much oil the pump is delivering each minute, it is simple to compute how long it will take to move the piston from position "X" to position "Y".

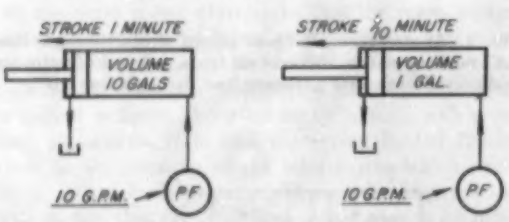


Fig. 4. Cylinder speed depends on pump capacity and cylinder size.

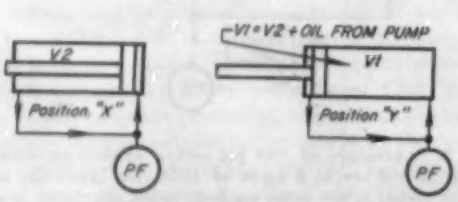


Fig. 5. The differential circuit.

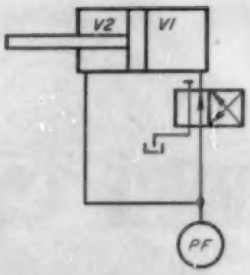


Fig. 6. With the manually controlled three-way valve in the position shown we have a differential circuit. With the valve in the other position, pressure oil will flow to the rod end only and exhaust oil from the head end will flow to the tank.

In Figure 6 the speed of the work stroke, taken with pressure on the rod end, will be constant. It will depend on the capacity of the pump used. The speed of the return stroke, as we learned from Figure 5 is dependent on the ratio between V_1 and V_2. Any desired ratio can be obtained by design of the rod.

Figure 7 shows three possible conditions in the rod design. In "X" we have a 2 to 1 ratio, in "Y" a 3 to 2 ratio and in "Z" a 4 to 3 ratio. The volumes V_1 and V_2 will be in the same ratio as the areas. A little study of Figure 7 will show that with a 2 to 1 ratio the oil required from the pump will be the same in each direction. Since the pump has a fixed capacity, the speed will be the same in both directions. This application is often used on machines such as surface grinders where the table movement must remain constant. We can also see that in a 3 to 2 ratio only half as much oil will

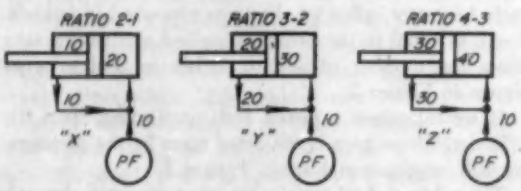


Fig. 7. Effect of rod design on the differential circuit.

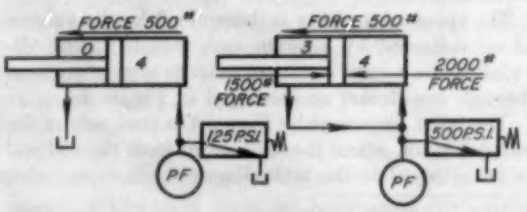


Fig. 8. Conventional and differential circuits.

be required to fill V_2 so the speed of the return stroke will be twice as fast as the work stroke. Some shapers use this circuit to get a fast return stroke. In "Z" on Figure 7 with the 4 to 3 ratio the speed of the return stroke will be 3 times as fast as the work stroke.

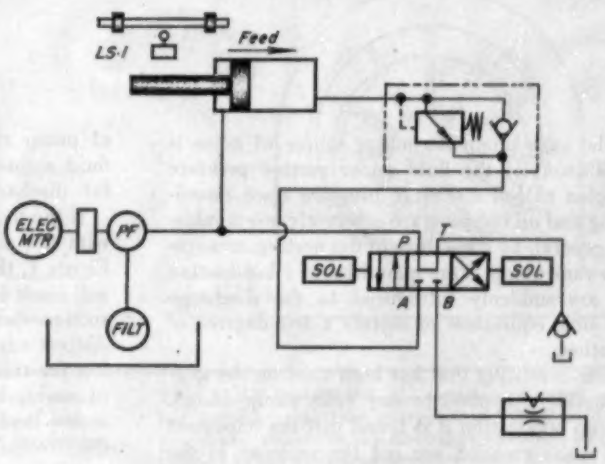
This application of the circuit is often used on machines having a long stroke and requiring fast cycling. On these pages are a photo and a hydraulic diagram of a high speed broaching machine whose piston annulus ratio is approximately 4 to 3. The theoretical speed of this machine is 30 feet per minute on the work stroke and 92 feet per minute on the return stroke. In actual practice, there are unavoidable losses, which will reduce the speed somewhat. The machine builder's claim of 65 feet per minute is conservative. This machine was designed for high speed production broaching of keyways and small holes and is a very good example of what can be done with the differential circuit.

Science tells us that nothing is free. What we gain in one direction, we lose in another. This is true of the differential circuit. As we gain speed, we lose power. By referring back to Figure 2, we can see that since the forces acting on the piston are equal, we have lost all our power. Care must be taken in designing a differential circuit to determine the power required on the return stroke.

Another point to be considered before using a differential circuit, is the pressure limitations of the circuit. A differential circuit must operate under higher pressures than a simple circuit. To illustrate this, let us compare a simple circuit with a differential circuit on a machine which requires 500 lbs of force to move the piston on its return stroke.

A comparison of the two sketches in Figure 8 will show that where 125 psi is sufficient in the simple circuit, it will take 500 psi in the differential circuit. The same amount of work will be done in each case. The differential circuit will do the work in 1/3 of the time. We can overcome this fault by increasing the size of our piston cylinder and rod—where possible.

Differential Circuit Speeds Broaching



In the development of a high speed broach, Zagar Tool, Inc., Cleveland, Ohio used a differential circuit. The working area (piston annulus) is ¾ the return area (piston head). This ratio of areas used with a differential circuit will theoretically give a return speed three times the work or broaching speed. This particular machine can operate as high as 700 strokes per minute.

During the broaching stroke, pressure oil acts on the rod end. A bypass flow control regulates speed and a counterbalance valve creates a backpressure on the broaching tool. On the return stroke, pressure oil acts on the head end and oil from the rod end is returned to the pressure line. The use of a differential circuit on this application is particularly advantageous because the penalty of less available force which is paid for higher return speed is not important on an application where the required returning force is small.

PART 2

VANE AND PISTON PUMPS

HYDRAULIC NOISE..

By E. L. Midgette

IN the vane pump the major source of noise is the introduction of the fluid under suction pressure to the region of full discharge pressure since incomplete filling and oil trapping are inherently less troublesome. In general, by the nature of the porting arrangement of a vane pump, large quantities of oil at suction pressure are suddenly introduced to the discharge side in a time equivalent of merely a few degrees of shaft rotation.

The same reasoning that has been used on the gear pumps should be applied to any vane pump design. However, on application it is found that the important points of noise creation are not the same as in the gear pump. Since the common commercially available vane pumps depend upon a combination of centrifugal force and discharge pressure to hold the vanes against the outer race, it follows that there is no possibility of really trapping fluid at the end of the discharge port since the essential force holding the vane against the case is due to pressure beneath it, and any pressure in the trapped fluid that exceeded that in the discharge port would depress the vane. Filling in the vane pump, though important, is simpler than in the gear pump; since it is possible to arrange the port in such a way as to allow a very free direct flow of fluid into the suction area during a time approaching 90 degrees of shaft rotation and in many vane pumps for a time equivalent approaching 180 degrees.

The main source of noise coming from this type of pump results from the transfer of low pressure fluid across the seal land at the end of suction into full discharge pressure.

If the theoretical minimum number of vanes is used with the ports arranged in the theoretical positions, Figure 1, this transfer is practically instantaneous and will result in a high noise level. Precompression of this suction fluid before it enters discharge would be of distinct advantage. Perhaps the easiest way of arranging for this precompression is to double the number of vanes, Figure 2, thus dividing the fluid over the sealed land into two quantities instead of one. Then the discharge port entrance position can be delayed an amount such as to insure that the fluid held between the two vanes closest to the discharge opening would have to assume a volume smaller than that available when it was at low pressure. By controlling the amount of this volume change to that amount required to compress this quantity of fluid to discharge pressure, one can be sure that when this fluid finally enters the discharge port its pressure is already equal to that in the port.

PISTON PUMPS

The designer of the ported piston type pump, of the axial or radial type, is faced with a heavy noise problem. The problem of filling is of secondary importance in comparison with that of the sudden introduction of low pressure fluids into the high pressure region, and the problem of trapping fluid across the seal between the leaving end of the discharge port and the suction side. Under certain common conditions, the sudden introduction of a quantity of low pressure

E. L. MIDGETTE, Head of Mechanical Engineering Dept. Polytechnic Institute of Brooklyn

- Adequate filling must be provided in all pumps if noise is to be kept to a minimum.
- Low pressure fluid must not be suddenly introduced into high pressure regions.
- Eliminate trapping of fluid at full discharge pressure at the leaving end of the discharge port between the rotor and the seal land.
- Low operating speed reduces hydraulic noise caused by extremely rapid time rates of pressure change.

...in Positive Displacement Pumps

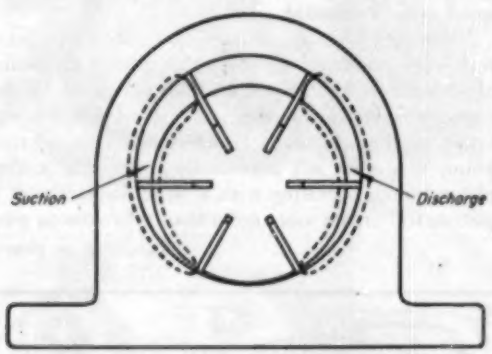


FIG. 1. THE MAIN SOURCE of noise in a vane pump results from the transfer of low pressure fluid across the seal land at the end of suction into full discharge pressure.

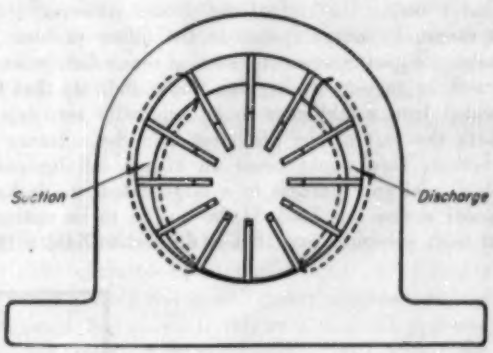


FIG. 2. BY DOUBLING the number of vanes and shifting the discharge port entrance, the fluid held between two vanes, closest to the discharge opening, will be compressed to the discharge pressure when it enters the port.

fluid into the high pressure region is only one of the two major sources of noise in this kind of pump. Clearly the designer, to lower the noise level, must greatly lower the time rate of change of pressure on distinct quantities of fluid.

It follows, that, providing discharge pressures are going to be held reasonably close to a known average, real advantage would be experienced if the porting could be so arranged as to cause a gradual compression of the fluid being transferred across the seal land separating the suction from the beginning of the discharge region. Fortunately one can determine by calculation, the length of the seal land necessary in order to precompress this fluid to a pressure equal to the average existing in the discharge port. It can be approximated very closely by merely determining what degree of rotation away from dead center position must be made by the rotor to give the piston a displacement equal to the change in volume necessary to pressurize the volume of fluid above it. That volume change is determinent due to the bulk modulus, for a rise in pressure equal to the difference between suction and discharge pressures.

Since there is a certain amount of leakage taking place past both the piston and the seal lands when the pressure begins to build up, the simple calculations indicated above will determine a seal land length that is on the low rather than the high side. With clearances around the parts known, it is possible to modify these calculations by taking into account leakage rates that will occur as the pressure builds up. With this correction, the calculated length of seal land should be very close to the optimum desired. Figure 3 illustrates this correction.

The next point to observe is the possibility of trapping fluid at the end of the stroke in the small clear-

ance volume remaining between the end of the piston and the seal land. Any positive lap of this seal land from the leaving end of the discharge port into the suction side will trap fluid between the piston and the seal before the piston has reached the end of its stroke. Granted the amount of piston position change occurring over a small positive lap will be slight. However, the amount of fluid trapped is usually very small in volume and therefore a very slight change in piston position may build up very high pressures over the piston top during this short period. Resulting pressures created may reach two or three times average discharge in an almost instantaneously short period of time, thus creating extremely high rates of pressure change with the resultant noise.

SOLUTION TO THE TRAPPING PROBLEM

This whole trapping problem can be eliminated by reducing the lap in such a way as to insure that the fluid above the piston is not cut off from open discharge before the end of the stroke. However, since it is usually advantageous to the filling problem to have the piston open to suction immediately as it starts its suction stroke, this would indicate that the sealed land would have to be kept with zero lap at both the exit of the discharge and the entrance of suction. This would mean an almost infinitesimally short seal and increase to a large extent the leakage losses across this land. If the unit is to be operated at high pressures and if it is desired to hold a high volumetric efficiency, this excess of leakage is very undesirable.

In the author's experience this problem may be best handled by leaving the fluid above the piston open to the discharge side until the piston has come so close to the end of its stroke that the leakage due to discharge pressure past the piston through its cylinder bore may be made equal to that volume displaced by the piston during the little stroke remaining at the point of cutoff. Calculations can readily be made to determine the leakage past the piston through its cylinder bore and, when determined, it is then only necessary to equate that to the fluid that would be displaced by the movement of the piston during the time it is passing the positive lap.

Since noise is created by rapid changes of pressure and is increased as these rates of change of pressure increase, it follows that despite all the corrections that one can place in the design of a pump for quiet operation, it is mandatory that operating speed be held at the lowest value consistent with economy of size, weight and manufacturing costs. One other reason for rapidly changing pressures in positive displacement pumps is that due to the varying flow rates into discharge from each piston even though pump speed is held constant.

It has long been appreciated that piston type pumps with small numbers of pistons give greater fluctuations of pressure in discharge lines than pumps of the same capacity operating at the same speed but having a larger number of pistons. However, from a noise standpoint, this does not necessarily mean that a three-piston pump, operating with a large displacement per piston, will create more noise than a five-piston pump,

Concluded on page 100

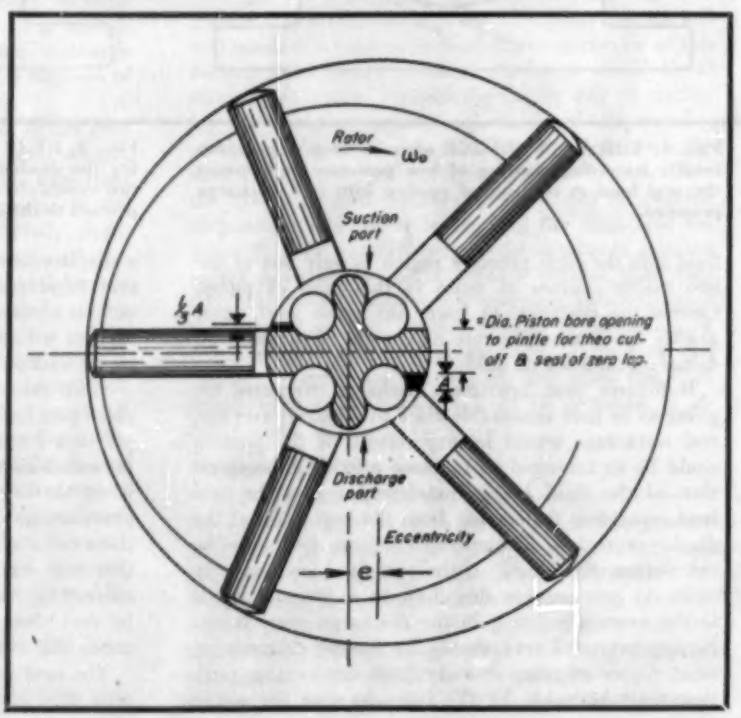
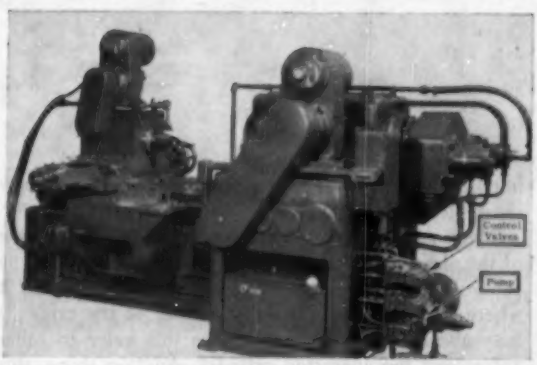


FIG. 3. SEAL LENGTH between suction and discharge is increased to precompress the fluid being transferred across the seal land. This design change minimizes noise caused by sudden introduction of low pressure fluid into the high pressure side. Seal length between the discharge and suction is increased to minimize noise caused by trapping of fluid.

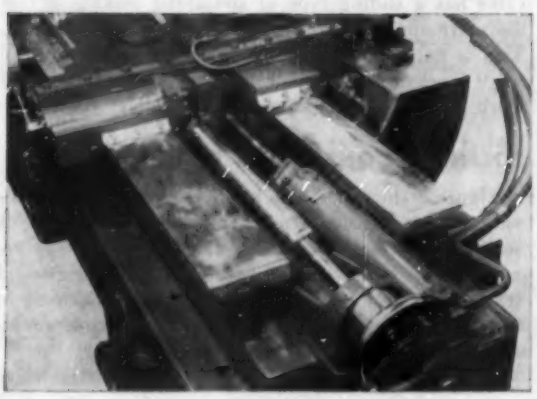
OIL POWERED DEVICES

. . . ADD speed and accuracy to thread millers

RAPID TRAVERSE of the tool carriage and operation of the 3 jaw wedge chuck are performed with hydraulic power on this thread miller. The 12 gpm variable volume pump requires only 1½ horsepower from the electric drive motor. Maximum operating pressure of 300 psi is developed when the pump delivery drops to low volume for clamping. Low pressure oil flow through ¾ and ½ inch tube and hose results in a trouble-free hydraulic system.



FOUR CONTROL VALVES are used in this circuit. Two pilot operated-solenoid controlled valves and a pressure reducing valve are gasket mounted on the valve panel. Not shown in this view is a cam operated valve for decelerating the carriage. The 3 jaw hydraulically operated wedge chuck is optional equipment which is selected wherever uniformity in the size of the work is necessary and where a high production rate is a factor. With this chuck, the part can be uniformly centralized and chucked and unchucked very fast. Use of the oil powered chuck has gained wide acceptance in the oilfield and related industries where the threading of tool joints and drill collars is a precision operation.



MOUNTED at the "tailstock end" of the thread miller, this 2½ inch bore 14½ inch stroke cylinder provides the rapid traverse for the tool carriage. The forward stroke is limited by a cam operated bleed off valve which opens to divert oil delivery from the blank end of the cylinder to tank. Pushbutton actuation of a solenoid controlled valve initiates forward and reverse motion. With a 12 gpm flow, the carriage rapidly traverses at a rate of approximately 45 fpm.

Comparing CAM *and* SOLENOID *Operated* FEED CIRCUITS

● Three different methods are shown schematically for providing a transition from rapid advance to feed, with means provided similarly by check valves for obtaining rapid return. The partial circuits shown are basic, there being many variations of each.

By E. H. Gatwood

When a tool or work slide must be moved in rapid approach, feed and rapid return, the machine designer has available a variety of hydraulic circuits to do the job. The three circuits illustrated in this article are representative of feed circuits using constant displacement pumps and meter-out flow control valves. Changing from rapid advance to feed can be accomplished by use of a cam operated or solenoid controlled valve.

CAM OPERATED CIRCUIT

Figure 1 illustrates a cam operated valve for providing the transition from rapid advance to feed. This plan is the most reliable if arranged so that the valve is depressed by the cam to obtain the transition. If the valve should hang up, the entire forward stroke will be at feed rate which is usually considered safe. Because of this plan's reliability, feed may be started close to the work thereby minimizing lost time approaching the work at feed speed. Another principal advantage is that, by careful cam design, a smooth speed transition may be obtained. This is of particular importance when the speed change is great and considerable mass is involved.

There are some disadvantages in this plan. Because of the size of the cam operated valve—it must handle full volume—it is sometimes inconvenient to mount it where it may be operated by motion of the table. It may also be inconvenient to pipe this valve to other valves and the operating cylinder. Another thing, this valve has a sliding type of spool and leakage across the valve spool, when depressed, must be considered. This is particularly important when the flow control valve is set to pass a small flow and when variation of work load causes pressure to vary widely.

SOLENOID CONTROLLED FEED CIRCUIT

Figure 2 shows a solenoid controlled valve for providing the transition from rapid advance to feed. A solenoid-controlled, pilot operated valve may be required here if the volume to be passed during rapid traverse is large. Usually, this type of valve, used in this manner, will require pilot pressure from an independent source.

Principal advantage of this plan is that the valve

E. H. GATWOOD, Vickers, Inc., Detroit, Mich.

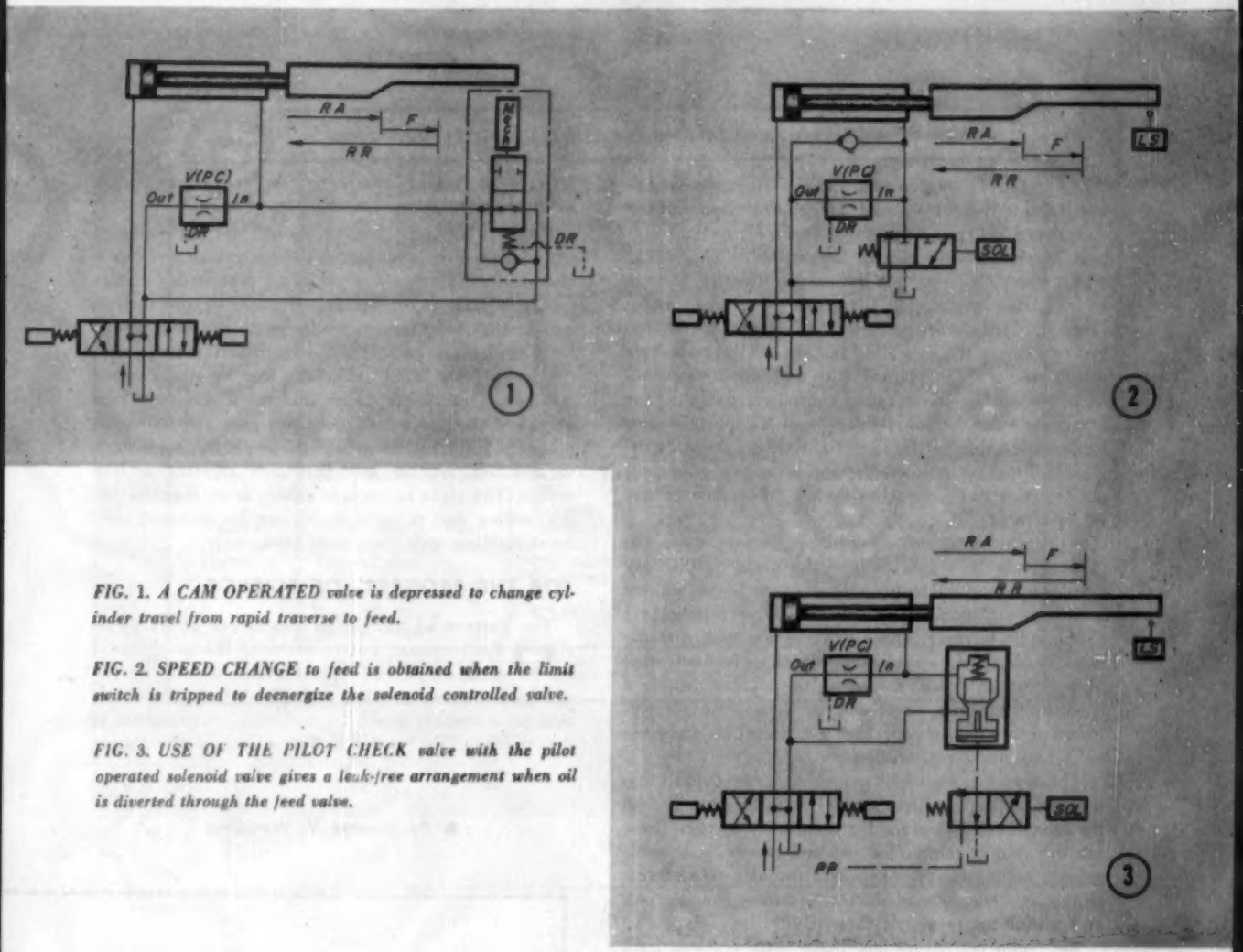


FIG. 1. A CAM OPERATED valve is depressed to change cylinder travel from rapid traverse to feed.

FIG. 2. SPEED CHANGE to feed is obtained when the limit switch is tripped to deenergize the solenoid controlled valve.

FIG. 3. USE OF THE PILOT CHECK valve with the pilot operated solenoid valve gives a leak-free arrangement when oil is diverted through the feed valve.

lends itself to panel mounting along with the other valves thereby minimizing the amount of piping and facilitating service. Also, it is often more convenient to mount a limit switch than a large cam operated valve where they may be actuated by table travel. The check valve is added to simplyify the electric control circuit.

There are some disadvantages. This arrangement is not as reliable as the plan in Figure 1. Common practice arranges the circuit as shown so that in case of malfunction of the electric control circuit the system will "fail safe". The solenoid is deenergized for feed. Safety, then, depends on mechanical reliability of the valve. If the spring should be incapable of returning the valve spool when the solenoid is deenergized, the table will continue in rapid traverse. Also, it is sometimes difficult to obtain reliably and accurately a smooth speed transition. In order to be safe, feed must start well ahead of contacting the work. The same disadvantage of leakage past the sliding type spool is present here as was described for Figure 1.

USE OF A PILOT OPERATED CHECK VALVE

Figure 3 illustrates a pilot operated check valve controlled remotely by a solenoid controlled pilot valve.

Principal advantage of this plan is that the valve when closed, is virtually leak-proof, it being the poppet type valve. This plan should be used when the flow control is set to pass a small amount of flow and when variation in leakage due to variation in pressure would render the other two plans impractical. This valve may also be panel mounted.

As to disadvantages of this plan, its reliability is comparable to the plan shown in Figure 2, and smooth speed transition is very difficult to obtain although a restriction in the pilot line will help.

Each of the plans has its advantages and disadvantages. Items listed as disadvantages are not necessarily disadvantages but precautions and each should be given its due consideration. The relative merits of each plan should be considered when a feed control application is planned.

PATENTS,

● By George V. Woodling

PATENTS, trademarks and copyrights cover separate and well-defined areas of legal protection, but the differences between these three types of legal protection are not always clearly understood.

A person shopping for a new car usually collects all available advertising literature presenting photographic illustrations, artistic sketches and text material describing the appealing features of the respective makes of car. The printed text and illustrations on each piece of such literature—circular, pamphlet or catalogue—are the subject matter of a copyright and, to be registrable in the Copyright Office, these "writings" must have printed thereon a proper copyright notice, such as "Copyright (year) by (name of car manufacturer)."

When the prospective purchaser decides upon the make of car he wants to buy, the name of that car becomes important to him. That name is the subject matter of a trademark and is likewise very important to the manufacturer. The protection for such a trademark is obtained by registering the same in the United States Patent Office. Contrary to popular belief, a trademark can never be protected by a copyright registration, nor can copyrightable material be protected by a trademark registration.

The new car owner will, of course, have checked into the new and special mechanical features described in the advertising literature for each make of car. These are the subject matter for patents. Briefly, patentable subject matter includes new and useful products, machines, compositions of matter, processes, or any new and useful improvement thereof.

The following definitions of the three types of legal protection of ideas point the distinguishing characteristics of each:

A patent is a printed document issued by the U. S. Patent Office which gives an inventor the right to exclude others from manufacturing, selling and using the patented invention for 17 years—the life of a patent. Patents are not renewable, but patents for improvement inventions may be obtained.

A trademark is a mark, picture or printed word or words (sometimes referred to as the commercial signature) applied to goods of a manufacturer or seller so that the public can distinguish the goods which are manufactured and sold by such manufacturer or seller from similar goods manufactured and sold by someone else. A trademark registration is issued by the U. S. Patent Office for a term of 20 years and is renewable repeatedly for like periods of 20 years as long as the trademark is continuously used.

A copyright gives the copyright owner the exclusive right to produce or reproduce his literary or artistic work. It prevents others from copying the literary or artistic works of the copyright owner. A copyright certificate of registration is issued by the Library of Congress (Register of Copyrights) for a term of 28 years and is renewable for another period of 28 years, making a total of 56 years.

Property in a trademark should not be confused with property in a patent. A company may develop a new device and obtain a patent to protect the unlawful appropriation of the construction of the device, and at the same time may designate the new device by a trademark and obtain a registration to protect the device from being unlawfully sold by others under the same trademark. The trademark indicates the origin of the goods and does not give any exclusive property right in the article to which the trademark is attached, nor in any invention residing in the article. The right to exclude others from manufacturing, selling and using a device can be obtained only by complying with the patent laws.

FOR THE PROGRESS OF SCIENCE

The purpose of the patent laws is not primarily to reward the inventor, but to promote the progress of science and the useful arts for the benefit of the public. Every inventor has the difficult task of showing that his invention meets the technical requirements of patentability. He must not only convince the Patent Office of the patentability of his invention, but also must stand ready to support the validity of his patent when he sues an infringer.

The Constitution of the United States does not authorize the protection of trademarks as it does that of patents and copyrights and for this reason, a trademark is sometimes referred to as an "orphan" in the law. In a trademark, it is its adoption and use on the goods in commerce that create the rights which the courts protect. The continued use of a trademark by its owner is essential to its validity and right to exclusive ownership.

Ownership of a trademark is a common-law proper-

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	Patents	Trademarks	Copyrights
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Rights Granted	To exclude others from manufacturing, using and selling devices embodying patented inventions	To keep others from using mark on similar goods which might confuse the public (prevent others from unfairly competing with similar mark)	To bar others from copying (Copyright means right to copy, but gives no right to ideas expressed in work)
Who May Obtain	Any inventor (adult, minor, citizen, alien, and any natural person; dead or insane inventor by representative)	"User" of the mark; only person or company who has actually adopted and used the mark on goods in commerce	"Author" of the material; may be an individual or corporation (Owner of the right)
Term	17 yrs. not renewable*	20 yrs., renewable from term to term as long as mark is used; affidavit of continued use after five years	28 yrs.; renewable for 28 yrs. more — total of 56 yrs.
Where to Apply for Document	Patent Office — Commissioner of Patents Letters Patent	Patent Office—Commissioner of Patents (Trademark Div.) Trademark Registration Certificate	Library of Congress — Register of Copyrights Copyright Registration Certificate
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*Design patents cover only appearance or outside effect and differ from other patents in that they are issued, at the option of the inventor, for terms of 3½, 7 or 14 years, with corresponding fees of $10, $15 and $30.

TRADEMARKS and COPYRIGHTS

ty right founded principally upon the basic concept of unfair competition and the general equitable principles governing such practices. Throughout the years, the courts have enunciated sound equitable principles for the protection of trademarks and now many of these principles have been incorporated and codified into the new trademark law which affords more direct and effective redress against unlawful use. The best way to obtain effective redress against unlawful use of a trademark is to register it in the U. S. Patent Office.

The Patent Office serves as a kind of clearing house for the prevention of duplication in trademarks. All registered trademarks are placed on file and open to public inspection. An interested party may, by making a search of the records, avoid the adoption of a trademark already adopted by another.

An important advantage of a trademark registration is that it entitles the owner of a trademark to mark his product with the notice: "Reg. U. S. Pat. Off.", or just the letter "R" enclosed in a circle, thus, ®.

LEGAL NOTICE

Compliance with the marking statute constitutes legal notice to the public that the owner has regis-

Concluded on page 111

TWO-PRESSURE CIRCUIT

. . . . uses a pilot controlled relief valve . . .

● By Hadley Kline and Henry Green

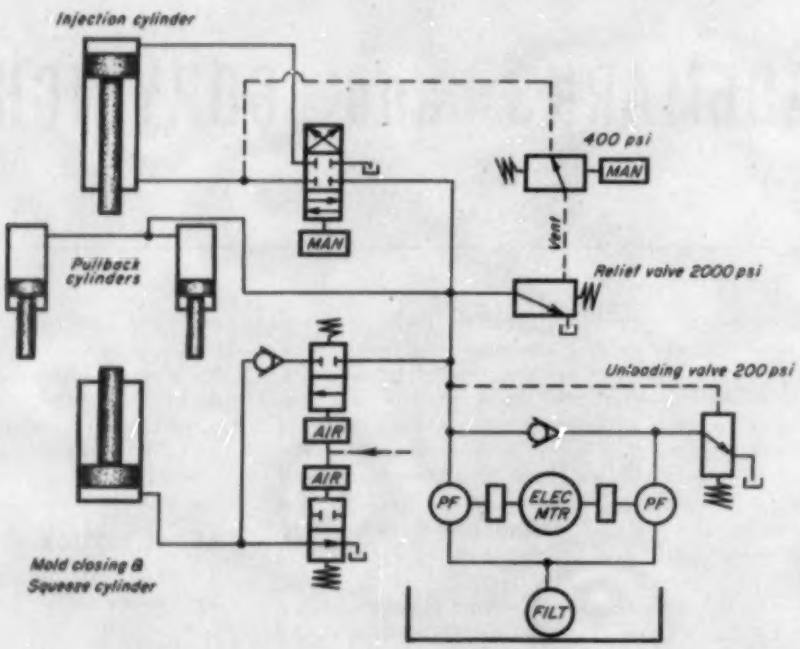
Plastic plunger molding machines require a hydraulic system which provides two different pressures. A high pressure is needed on the mold closing cylinder, and a low pressure is needed on the shot cylinder.

On presses in the Ackerman Plastic Molding Div. of Consolidated Iron-Steel Mfg. Co., Cleveland, this two pressure requirement is met by the circuit shown in the drawing. The two pressures are obtained by a high pressure relief valve which is vented at the proper time in the press cycle through a low pressure pilot valve. This arrangement is simple and less expensive than the use of a pressure reducing valve.

The power unit has a double ended electric motor driving a 3 gpm, 2000 psi vane pump on one end and a 30 gpm vane pump on the other. A pair of air pilot operated 2-way valves control the single acting 18 inch bore mold closing cylinder. One valve is normally closed, the other is normally open. To close the press, air operates both 2-way valves—opening one and closing the other. Oil pressure builds up to the maximum 2000 psi.

When the manual valve controlling the injection cylinder is operated, high pressure in the large mold squeeze cylinder is locked in by the check valve. With the blank end of the injection cylinder open to pressure, the rod end is open to tank. At this time the 2000 psi relief valve is vented through the 400 psi pilot control valve so that the maximum pump pressure falls to the low pressure setting of the pilot valve.

Both pumps supply oil for rapid closing of the press cylinders. The large volume pump unloads when pump pressure exceeds the unloading valve setting.



HIGH PRESSURE, 2000 psi, is *first applied to the lower mold closing cylinder. Moving the manual control valve to lower the injection cylinder opens the vent valve to tank which drops pump pressure to 400 psi. High pressure is trapped in the lower cylinder by the check valve.*

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telescopic heavy duty cylinders multiple sleeve construction—low shut height with stroke up to 84" plain or pineye mountings—capacity push stroke up to 18 tons

plain threaded pineye

PISTON ROD FITTINGS

pineye base foot

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Pumps— 5 sizes - 5 0 to 100 g.p.m.
Motors— 5 sizes - 18 to 35 h.p.

H - series
Pumps— 5 sizes - 12 to 42 g.p.m.
Motors— 5 sizes - 6 to 16 h.p.

D - series
Pumps— 4 sizes - 12 to 30 g.p.m.
Motors— 5 sizes - 6 to 16 h.p.

C - series
Pumps— 3 sizes - 2 to 9 g.p.m
Motors—2 sizes - 2 to 4 h.p.

mountings	shafts	porting
flange pad	tapered	right or left side
wide flange	splined round	end

OIL HYDRAULIC VALVES

3-4 tandem — any type section furnished in any combination of sections

1-2 tandem — any type section furnished in any combination of sections

1-2 unit — any type control or spool action as required

control types—	spool actions—	portings—
single, double or double with float position	spring return, poppet detents or combination	top or side inlet top, end or bottom outlet

valves can be furnished with or without built-in relief valve

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4A-57

PACKING CARTRIDGE

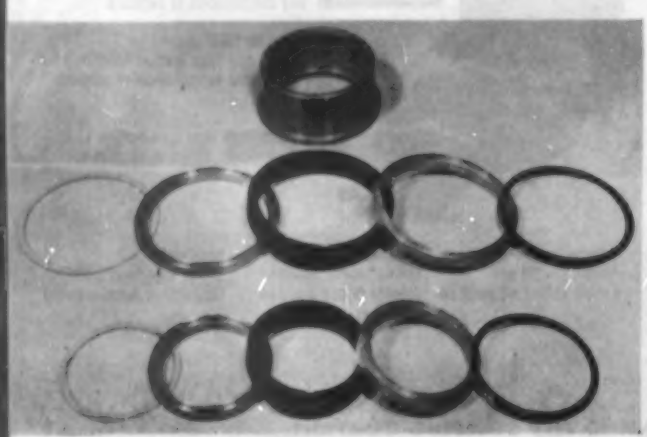
...for a telescoping cylinder

"TWO heads are better than one." When a cylinder manufacturer was asked recently by a builder of fork trucks for a compact, two stage or telescoping cylinder, the manufacturer recognized the fact that a successful cylinder for this purpose should utilize the experience of a packing specialist. Because of the critical importance of the packing, the joint efforts of the design-engineering groups of the cylinder and the packing companies were focused on this problem. The starting point was agreement that an effective answer to the design problem was a cartridge type packing.

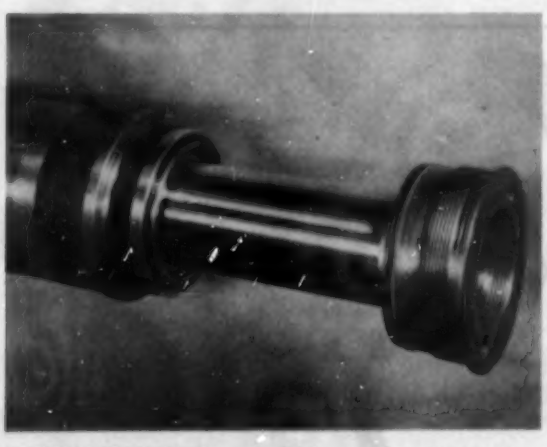
The three major problems of the conventional packing as applied to a two stage cylinder for industrial trucks were: (1) the time and skill required to repack the cylinder; (2) the leakage problem with conventional types of packing; and (3) the high coefficient of friction.

Since the specific application for the new design was the raising and lowering of the forks or platform of an industrial truck, the maintenance of packings becomes an important factor in keeping the truck in normal operation. The packing at the base of the first stage piston is buried the deepest or "at the end of the line" in a two stage telescoping cylinder. Of course, the two stage cylinder has other applications and much the same problem would present itself wherever such a cylinder was used.

The problem was given thorough study. The cartridge type packing as designed, tested and proven on application gave several advantages. First, the cartridge packing could be bench assembled and installed or removed as a unit in much less time than a conventional packing. Second, it assured a balanced, all vertical load, with no side load and no load on the structure. Third, packings are internal, keeping leakage to a minimum. Fourth, the cartridge, being inherently a low friction type packing, the movement of the piston does not cause a drag on the packing; the cylinder piston actually will move freely in the

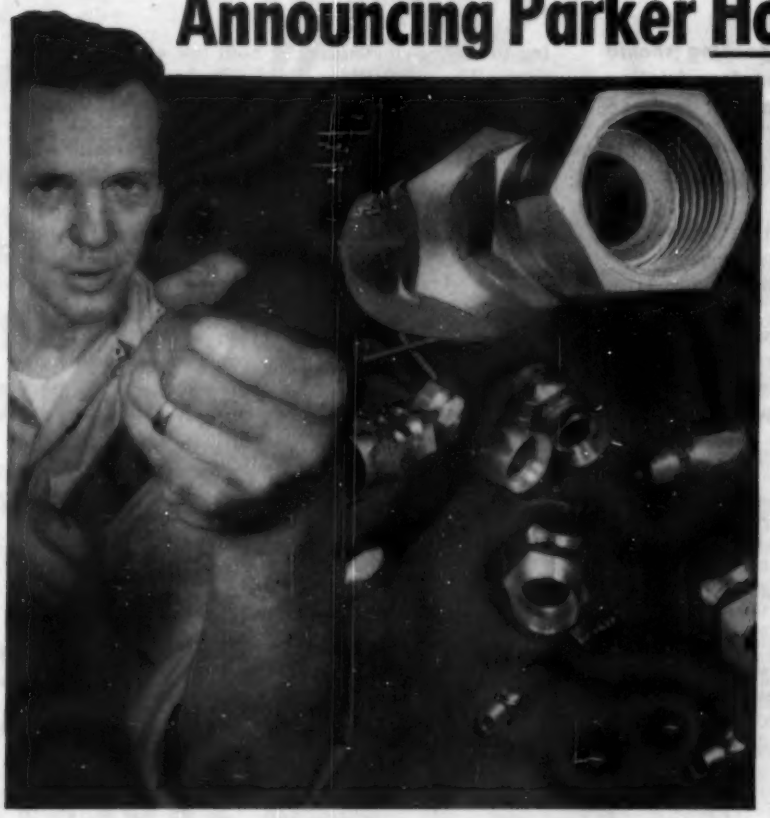


SEALING CARTRIDGE disassembled, showing cartridge body, top and bottom adaptors, automatic ring packings and snap rings.

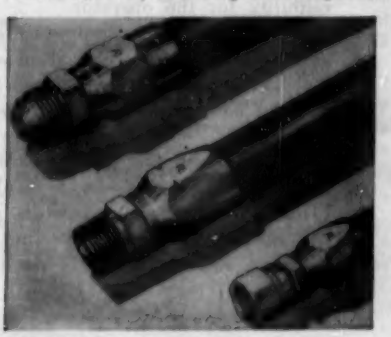


CARTRIDGE is bench assembled and slipped over the end of the piston rod. Assembly and replacement takes little time or skill.

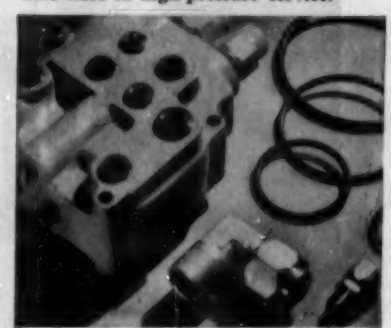
Announcing Parker Hoze-lok Fittings



S.A.E. Standards for hydraulic hose and fittings are fully met by Parker *Hoze-lok* fittings. See S.A.E. Handbook pages 725 to 730. Or, mail coupon for reprint.



3 styles: for cotton-covered or rubber-covered single-wire hose in medium pressure service; for rubber-covered, double-wire hose in high-pressure service.



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Hydraulic and fluid system components

. . . a cylinder rod packing should be easy to install, have low friction and allow minimum leakage

assembly due to its own weight. Fifth, there is no gland pressure required for sealing, assuring long service life. The cartridge packing needs only to be "finger tight."

The premium advantage is that a two stage cylinder with cartridge packing has a smaller overall cylinder diameter, thereby resulting in space saving compared with the same capacity cylinder using conventional packings. In an industrial truck this factor is of particular value since it results in improved forward visibility for the operator.

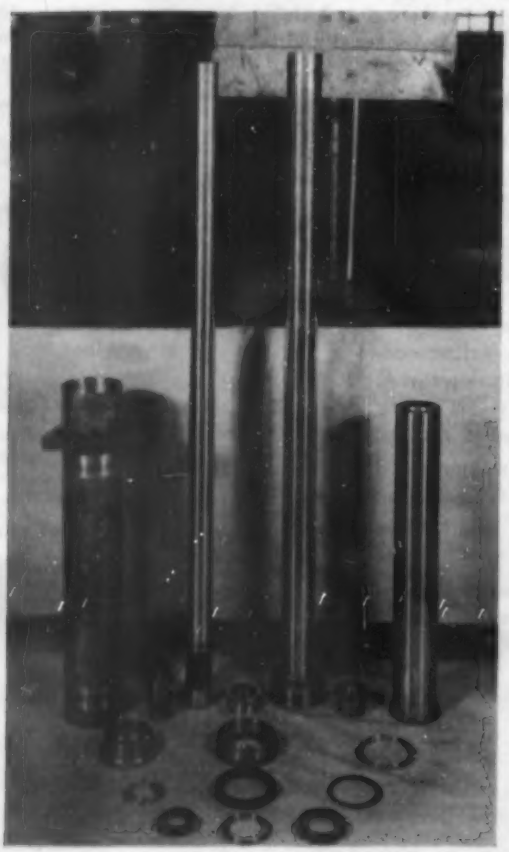
With the cartridge design settled upon, the key to its most advantageous utilization was the type of packing. The characteristics required of a cartridge packing are compactness, low friction and high sealing efficiency.

An automatic ring packing was selected. It is compact since each ring stacks evenly on another ring. Friction is low because lips are positioned diametrically and vertically by the center section of the sealing ring. The stack of rings needs only finger tightening to seal, giving sealing at both low and high pressures. When deflection of the cylinder rod occurs at full extension of the cylinder, the flexible, self-adjusting nature of the ring packing permits the rings to expand or contract, maintaining a tight seal.

The cartridge packing design for the two stage, telescoping cylinder has undergone rigorous testing and actual job service. Higher, smooth rates of piston travel, both extension and retraction, have been consistently obtained. Greater efficiency resulted from the lower friction; the higher power was available for useful work. Examination of rods and packings after sustained overload operation revealed practically no evidence of wear and very little leakage.

Since telescoping cylinders in industrial trucks are subject to severe service conditions, the speed and precision with which the cartridge packing can be assembled and replaced in a cylinder assembly is a valuable advantage in service and maintenance; the shorter downtime periods and fewer times out for packing adjustment and replacement reduces the overall cost of operation.

Acknowledgements: we are indebted to Mr. Ray Ptak of the design-engineering staff of Hyreco Division, New York Air Brake Company and Mr. Louis Karnok of Johns-Manville for their assistance in the preparation of this article.



A FULLY DISASSEMBLED two stage telescoping cylinder showing all component parts.

COMPLETELY ASSEMBLED two stage telescoping cylinder.

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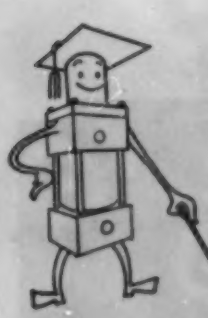

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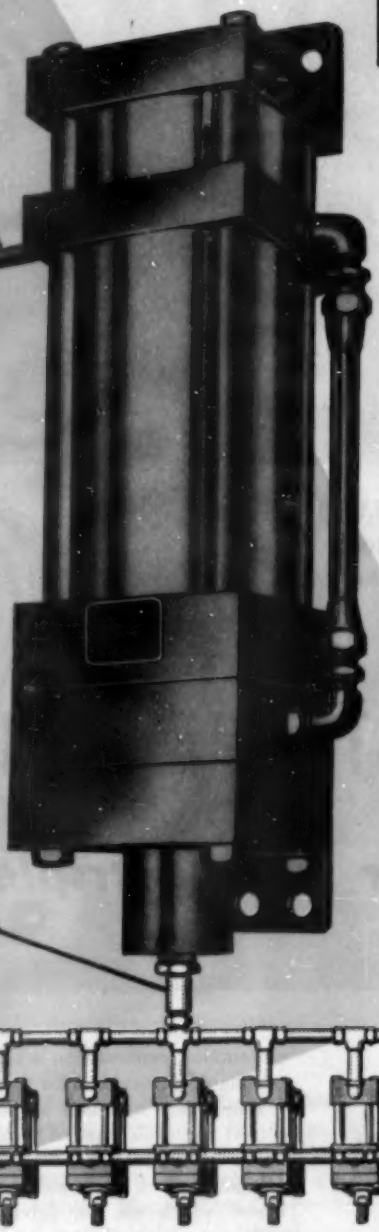
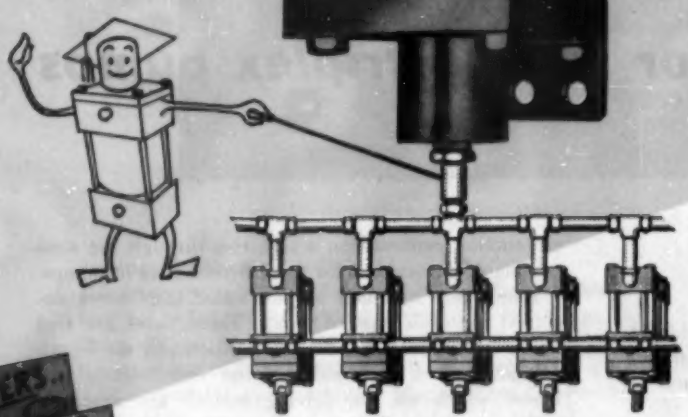
TO 2000 PSI HYDRAULIC PRESSURE

Output Range: 200 to 10,000 psi Fluid





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LAYOUT and INSTRUMENTATION

for testing triplex pumps

By J. E. Davee

NEW test facilities have recently been added to Worthington Corporation's already extensive test area. Part of these new facilities include a new stand for the testing of vertical triplex power pumps.

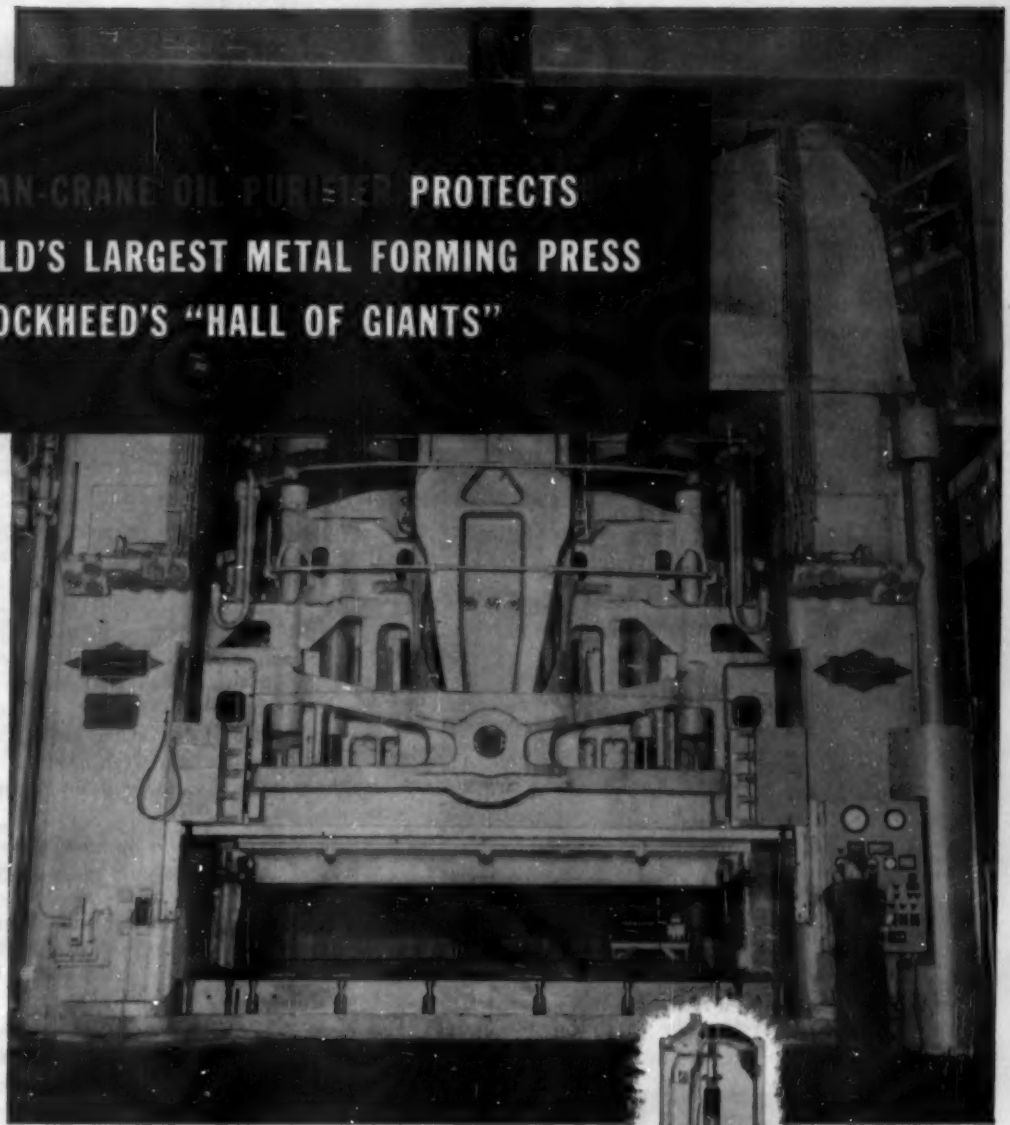
Since triplex power pumps must be run under both suction lift and suction head conditions, a booster line has been provided to give a positive suction head when required for testing the pumps. Positive heads up to 60 feet of water can be supplied by two vertical turbine pumps which are used as booster pumps. These booster pumps which require no priming, take their suction from a sump located at one end of the test area. The booster line runs down one edge of the center well below floor level. At intervals along the line are suction connections, which rise through the steel grating at the stations for the different sizes of pumps.

Pumps are mounted on fabricated steel bases designed for each type of pump. These bases are tied down to cast iron tee slot rails, which run the length of the area on both sides of the well; sliding rail bases, which all the driving motors are equipped with, are also tied down to the rails. This allows for great flexibility in set up, since a pump and driver can be tied down to the rails at any point in the test area.

Connection between pump and motor in most cases is by multi-V-belt drive. Since for standard pumps, the motor is already in place and positioned with respect to the pump base, all that is required to set up the pump for test is to bolt the pump down to its base, select and mount the proper sheave for the pump shaft to give the correct speed ratio, put on the belts and tighten them by sliding the motor back on its sliding base. No troublesome line up and shimming,

J. E. DAVEE, Reciprocating Engineering Dept., Worthington Corporation, Harrison, N.J.

HONAN-CRANE OIL PURIFIER PROTECTS WORLD'S LARGEST METAL FORMING PRESS IN LOCKHEED'S "HALL OF GIANTS"



Honan-Crane Bulk Refill Purifier No. 21300 with built-in pump and motor services Birdsboro press pictured. Purifier operates 20 feet below floor level. This model is capable of servicing a 2,000-gallon system.

● Aircraft sections up to 10 by 30 feet are formed from ½" aluminum sheets on this Birdsboro hydro press. Its overall height is 51 feet and its weight a staggering 2,750,000 pounds. Because clean hydraulic oil is a vitally important factor in the operation of this mammoth press, Lockheed gives it the safe, dependable protection of a Honan-Crane Oil Purifier.

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PUMP TEST INSTALLATION

such as is required using direct connected motors with couplings is necessary. For the protection of personnel working on the stand, each station has a belt guard which is set over the drive while the pump is running.

Sixty cycle, 3 phase, 440 volt induction motors ranging from 3 to 150 horsepower are available for testing at this stand. All motors have been specially calibrated for checking the brake horsepower required by the pump, by measuring the input power to the motor.

For ease of power connection all motors are fitted with special plug-in type conduit boxes. Power connection to the motors is by means of plug-in cables to a control cabinet at the rear of the test area.

PUMPS ARE V belt driven from induction motors which are calibrated for checking the required brake horsepower.

VERTICAL turbine pumps supply pressure for a positive suction head to the triplex pumps.

The control cabinet also houses circuit breakers, ammeters, voltmeters, and wattmeters, motor selector switches, and test blocks for plugging in portable type wattmeters. Portable wattmeters can be used to obtain more accurate readings of input power and the checking of the power board wattmeters. Also on the board are starter switches for the motors, and pilot lights to tell when the power is on. A special convenience, and safety device is an auxiliary cable containing a stop-start button, which can be plugged into the board and run to any pumping station, allowing the motor to be stopped and started at the pump. This is desirable as the pump can be shut down immediately in an emergency without having to go to the panel board. The starter switches for the booster pumps are also contained in the cabinet.

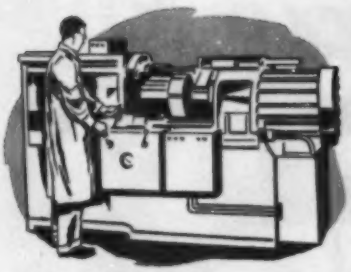
Piping for this stand presented a special problem, since there are more than 150 different types and sizes of pumps which must be tested with pressures ranging from 100 to over 10,000 psi, and with inlet and outlet connections from ¾ to 6 inch size. To solve this problem, a series of five different headers were made up for the suction and five for the discharge. Pump connectors were then provided to connect these headers to each of the various sized pumps. The pressure rating of the discharge headers is high enough for the maximum pressure of any set up that they will be used on.

When the pump is to be tested with a positive suction head the suction piping has to be connected to the booster line and then lined up with the pump suction inlet. In order to give the flexibility required to readily line up the piping with the suction inlet, short sections of flexible hose were incorporated in the suction headers.

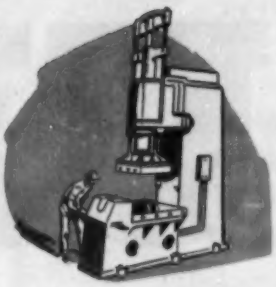
Vertical triplex power pumps are positive displacement pumps, which can build up enough pressure to burst the pump or pipe lines if the discharge line should be clogged or a discharge valve should be left closed, therefore, a series of relief valves were provided for protection. These relief valves cover the complete range of pressure to which pumps are tested on this stand, and can be easily attached to connections provided for them in the discharge lines.

Capacity is not usually measured on each pump test, since the capacities of these pumps are well established from previous tests. However, for cases where it is required, a 600 gallon portable measuring tank has been provided which can be piped into the discharge line and the capacity accurately measured.

Another "extra" of the test stand, which is available and may be set up and piped into any system if required, is a 3000 psi, 200 gallon air-water accumulator and air charging compressor. The primary function of this accumulator is to smooth out the flow of the pump discharge where this is desirable to give more accurate capacity and performance readings. It is also used to check the pump unloaders when operating under both loaded and unloaded conditions against a system pressure.



For hydraulic systems on all types of injection molding machinery.



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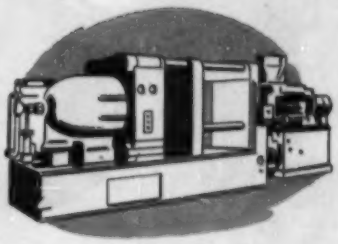

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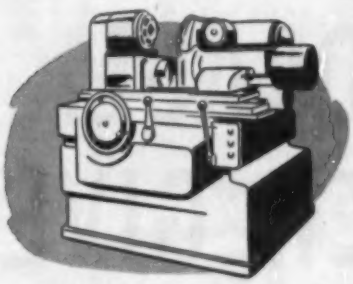
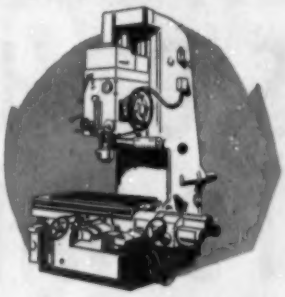


For hydraulic systems on grinding machines and other production tools.



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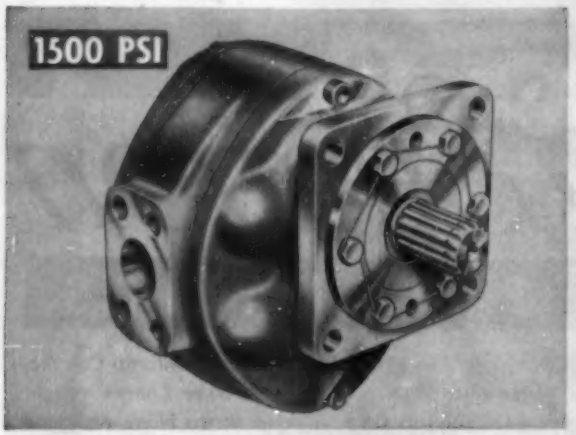

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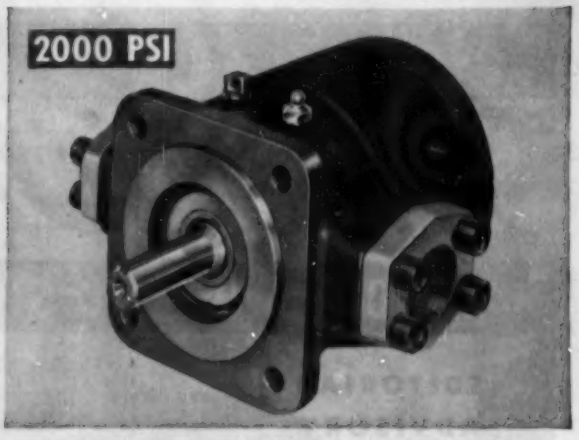

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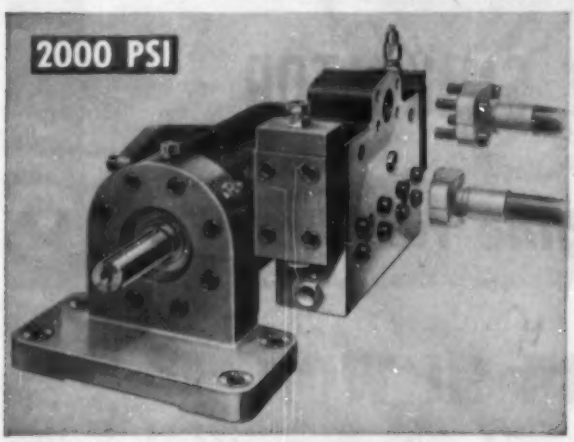

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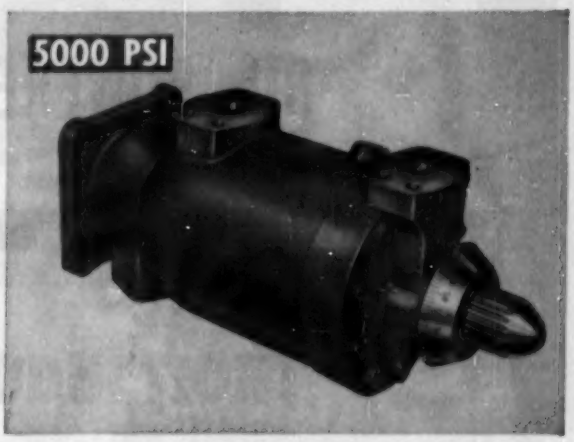

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OIL POWERED SIMULATOR

calibrates jet engine fuel control

● By W. S. Bobier, Jr.

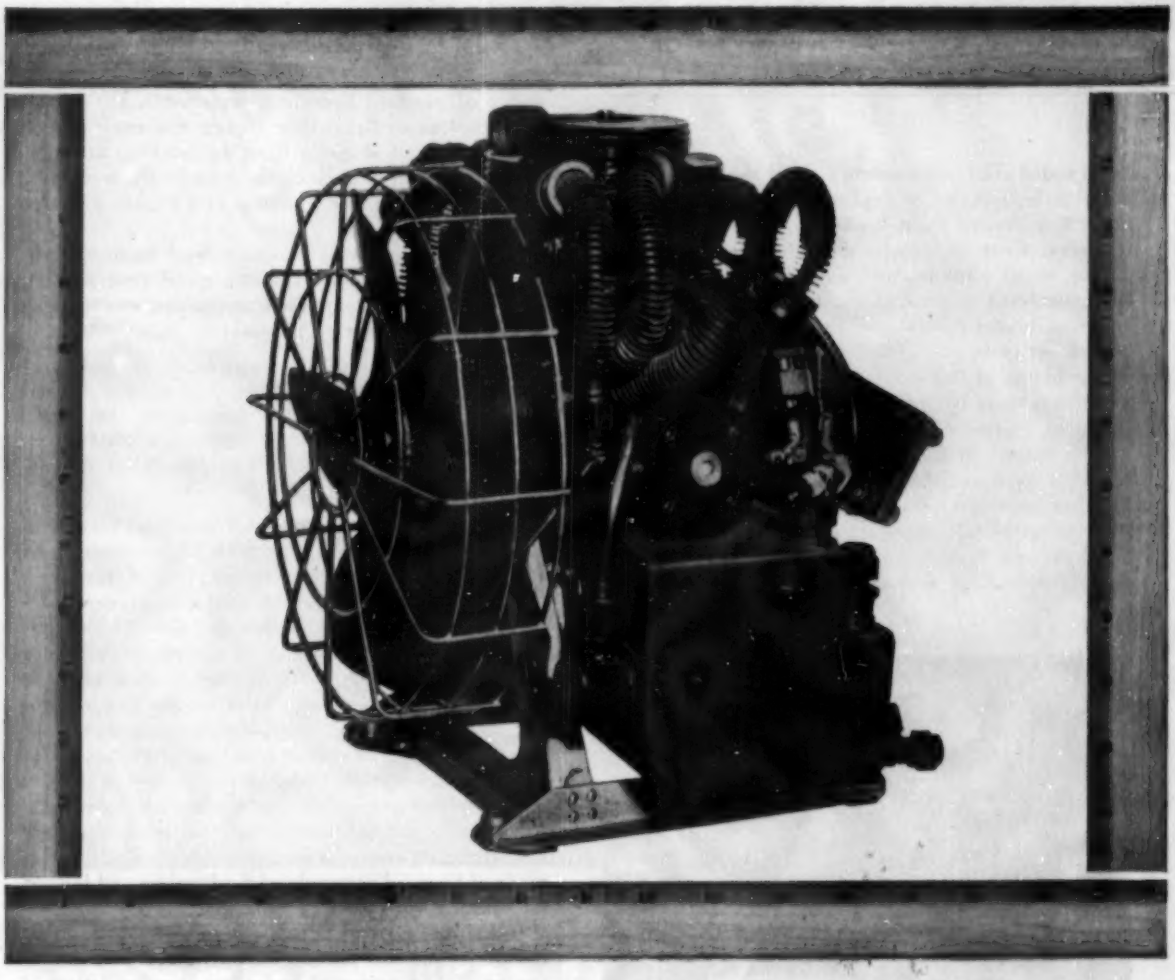
DURING the past few years, the trend in military aviation has been toward jet engines with tremendous horsepower compared to their predecessors of World War II. Published information reveals jet engines that will develop close to 30,000 horsepower under certain conditions. This great power, however, is accompanied by a corresponding high fuel consumption. During five hours of operation, one of these engines could use more fuel than the average motorist consumes in a lifetime.

The tremendous appetite of jet engines has made it imperative, for economic reasons, that the amount of engine running time required to render the engine ready for flight be kept to an absolute minimum. Jet engines generally have a short life compared to piston engines, so that a few hours saved in preliminary running time represents a considerable percentage increase in useful engine life.

Final calibration and test of the fuel control usually requires the greatest amount of engine ground running time. The need for producing fuel controls which are perfectly calibrated (when they come from the test stand) and require little or no engine calibration has led to the development of the jet engine simulator.

The test device consists of a hydraulic transmission and an analogue computor. These are combined in such a way that the output speed of the transmission responds to the fuel flow supplied by the fuel control

W. S. BOBIER, JR., project engineer Vickers Incorporated, Detroit, Mich.



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being tested. The transmission's speed response to fuel flow can be adjusted to duplicate that of a jet engine under any desired flight condition. In this manner, a fuel control can be tested under simulated flight conditions at all altitudes and aircraft speeds that will be encountered in service. The final result is a safer, better calibrated control, for about 2% of the present calibration costs.

The brains of this device are provided by an electronic analogue computer which can be readily adjusted to represent any current jet engine under an infinite variety of flight conditions. The muscles are provided by a variable speed hydraulic transmission that has been specially designed for the application. The feasibility of combining an analogue computer and hydraulic transmission in this manner was first proven by making a mock-up of a 50 hp test stand using a commercially-available computer and an assembly of standard hydraulic components. The mock-up worked so well that little change was made in the hydraulic circuit in going from the mock-up arrangement to the final design. Figure 1 shows the hydraulic equipment used in the mock-up and Figure 2 shows the circuit diagram.

During the course of design, several basic systems for obtaining test stand variable speed were considered. Of these, the hydraulic transmission was selected because of the following advantages:

1. High ratio of horsepower to weight and size.
2. Rapid and stable response to control signals.
3. Accurate infinitely variable speed control.
4. Integrating effect of transmission control.
5. Useable speed range from zero to 100 percent of rated speed.

Having selected a hydraulic transmission for this purpose, there were two methods of controlling its output speed from which to choose. One of these consisted of a constant pressure source supplying a hydraulic motor through a metering valve. The second method employed a variable stroke pump driving a fixed stroke hydraulic motor. Either of these two systems could have been employed on the fuel control test stand. The variable pump-hydraulic motor combination has the desirable feature that acceleration can be made a linear function of the control signal. A second advantage is that the acceleration and speed are virtually independent of external loads. In addition, the units are commercially-established with thousands of hours of accumulated field service and laboratory testing.

It was the goal of the designers to avoid limiting the ability of the Jet Engine Simulator to a single engine. To be universal and allow the simulation of

FIG. 1. A 100 HORSEPOWER electric motor drives a variable displacement hydraulic pump. Power is transmitted through a hydraulic motor to the fuel control mounting pad. A typical fuel control can be seen below and to the left of the caption frame.

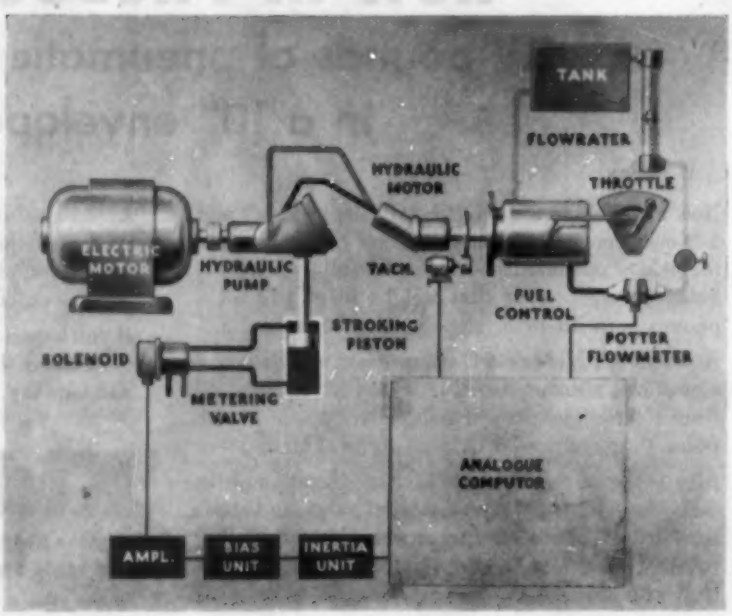

FIG. 2. BASIC ENGINE SIMULATOR hydraulic transmission circuit uses electronic controls.

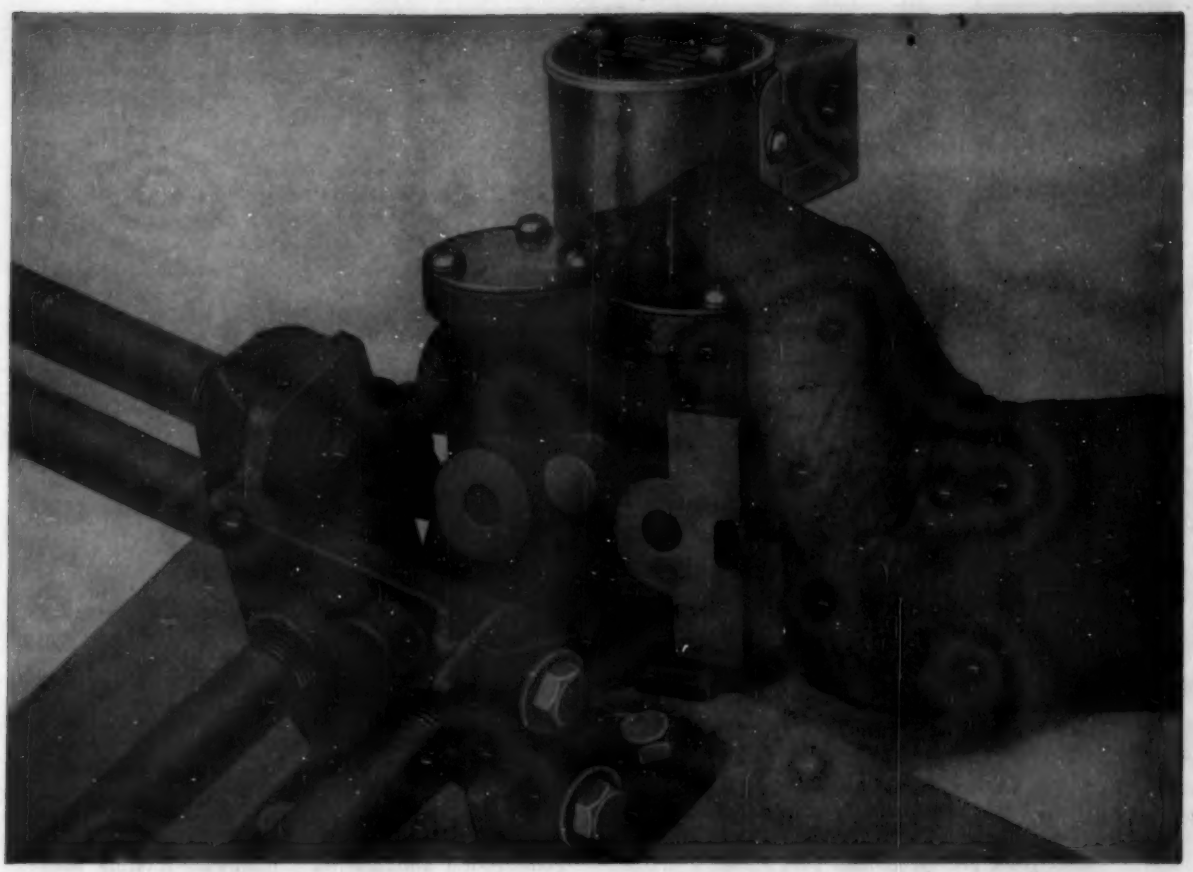

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FIG. 3. THE HYDRAULIC TRANSMISSION for testing of fuel controls is located in a room separate from the analogue computor. For safety, inflammables are contained in a separate area.

a wide variety of jet engines, including those made by various manufacturers, it was decided that it must meet the following minimum requirements:

1. The available power must be adequate to drive the fuel control requiring the greatest amount of power.
2. It must provide enough pads rotating in the proper directions to drive all the required fuel accessories for any system.
3. The speed range of the pads shall be sufficient to drive all of the fuel system accessories throughout their useful ranges.
4. It must be capable of supplying fuel at the proper boost pressure for every engine.
5. The fuel supply must be subjected to closely regulated temperature control.
6. It must be capable of supplying a fuel flow of from minimum to the maximum required by any known engine accessories.
7. It must be capable of simulating ambient pressure conditions at sea level and altitude.
8. It should be capable of responding dynamically to the fuel flow supplied by the control system in the same manner as the engine for which the control is designed.

To satisfy requirements 1 and 3, the hydraulic transmission was designed to have an output speed range of from zero to 3500 rpm with either direction of rotation. The transmission has a maximum continuous power rating of 100 hp at maximum speed. Satisfying the remaining requirements was accomplished in the design of the simulator fuel system and in the mechanical configuration of the gearbox.

The essential parts of the hydraulic transmission are as follows:

1. Solenoid: An electro-mechanical transducer which positions a pilot valve in response to an electrical signal.
2. Stroking Mechanism: A hydraulic force amplifier which changes the positive displacement of the variable pumps in response to the solenoid output.
3. Two variable displacement hydraulic pumps driven at 3681 rpm by a 125 hp, 1800 rpm 220/440 volt synchronous motor.
4. Two fixed displacement hydraulic motors and a gear box for driving the fuel control and its accessories.

This assembly of components provides a controllable speed at the fuel control mounting pads. The speed variation is accomplished by varying the displacement of the hydraulic pumps which are driven at constant speed. The variation in displacement is obtained by changing the stroke of the pumps by means of a control piston. This control piston is coupled hydraulically to the solenoid. The solenoid is actuated by an electrical signal.

The electrical signal that varies the pump displacement is derived from the analogue computor which senses the error between the desired speed and the actual speed. In this manner a closed loop speed control system with the ability to maintain close speed regulation is achieved.

To permit the rapid response of this system to the electrical control signals, the main circuit oil lines have been kept to a minimum length and diameter. The variable pumps and fixed motors have been designed to contain a minimum of oil volume under compression and possess a minimum rotating mass in order to permit extremely high accelerations. The output gearbox has also been carefully designed to keep the polar moment of inertia of the gears to a minimum.

REPLENISHING PUMP REPLACES LEAKAGE

To achieve the required power output, it was found advisable to use a dual set of hydraulic pumps and motors. A single stroking system controls both pumps which are mechanically linked together by the input gearbox. The main circuit lines are coupled hydraulically to equalize the load between the pumps and to prevent parasitic load oscillations which might occur if the two pumps were operated independently.

It is necessary to use a replenishing pump because this is a closed hydraulic system and leakage must be replaced from an external source. Replenishing pressure is supplied to both lines because during transients, power may be fed back from the hydraulic motors to the pumps, in which case the line which is normally the high pressure line becomes the low pressure line. Using check valves in the replenishing line allows this pressure reversal and the desirable braking action which is associated with it. Supplying replenishing check valves to both lines also allows the transmission to be automatically reversed in direction of rotation.

During severe transients or extreme overload, it is possible to demand a torque from the transmission which would cause it to exceed its maximum allowable pressure. To prevent excessive pressure and bear-

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Fuel Control Simulator

Concluded

ing loads, both hydraulic lines are protected with relief valves set at 3500 psi.

The hydraulic transmission has been so designed that all major electrical components are located in an area divorced from the general test area. This allows the use of a large percentage of non-explosion-proof electrical equipment. The only explosion-proof equipment required is that actually mounted on the test stand console.

CALIBRATING THE FUEL CONTROLS

The testing of jet engine fuel controls has in the past involved little more than steady state speed operation of the control at a number of speeds within its operating range with various power lever settings. This static type of test is at best a poor measure of whether the fuel control will operate satisfactorily with a particular engine, although it is a necessary first step in calibrating fuel controls. The jet engine simulator is not intended to eliminate this step in calibrating fuel controls, but rather to supplement the static calibration with engine simulation. The device can operate either as a static test stand or an engine simulator. To go from one operating condition to another, all that is required is to reposition the selector switch.

ENGINE STIMULATION

When the test machine is operated as an engine simulator, it responds to the fuel flow delivered by the fuel control in the same manner as the jet engine it is simulating. The only way in which a change in speed can be accomplished is by means of a change in fuel flow (throttle position).

The analogue computer takes manually-set adjustments for aircraft speed, altitude, and ambient temperature. These manual adjustments along with a signal representing the transmission's instantaneous rpm are used by the computer to calculate the equilibrium fuel flow that would be required for steady operation of the engine under these conditions. The simulator compares the equilibrium fuel flow for the instantaneous speed to the actual fuel flow and sends a signal to the hydraulic transmission causing an acceleration or deceleration of the transmission proportional to the instantaneous fuel error. If no error exists between the equilibrium fuel flow and the fuel delivered by the fuel control, the system will maintain a constant speed.

The simulator is started and shut down in a manner similar to that used on an actual jet engine. Since the simulator speed is responsive to fuel flow, it is necessary in order to start the simulator to first bring the system up to cranking speed in order to have sufficient fuel flow to make the simulator self-sustaining. To shut the simulator down, the usual practice is to move the fuel control's power lever to the stop position which shuts off the fuel flow and causes the simulator to come to a stop.

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Infinitely VARIABLE SPEED HYDRAULIC TRANSMISSION GEARS

Aluminium Sheathing Plant

Aluminium Sheathed Cable, pioneered and developed by Johnson & Phillips Ltd. in their Plant in Britain, requires, for its cheapness, lightness and easy installation, a special manufacturing technique. Owing to the difficulty of extrusion, oversize aluminium tube is drawn down on to the cable through a die by a large diameter Hauling Gear. For this process, as for many others in modern industry, accurate speed control and high torque at low speeds are essential. 'VSG' Drives have been selected to meet these requirements.

Are you aware of the full possibilities of 'VSG' Hydraulic Power Transmission? Write to us today and we will mail you further details.

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On mobile equipment there are advantages to be gained from using a . . .

Fan Belt Driven HYDRAULIC PUMP

By George D. Nichols

USING fan-belt drive as the hydraulic power source to operate special truck and tractor equipment is a relatively new and unexploited field. For certain applications, it offers economies and advantages not possible with conventional power take off drive.

We recently put into production a new redesigned fan-belt driven pump, valve and clutch unit for our line of underbody hoists, elevating end gates and snow plow controls. The quick and ready acceptance of the pump for other applications,—operating small truck mounted cranes, raising the sickle bar of tractor mounted mowers, raising the trailing axle of trailers when deadheading, and controlling the luggage loading ramp for airlines—shows that it has countless possibilities for utilizing hydraulic power economically and efficiently.

The pump is a high-pressure, gear-type unit that develops pressure up to 1500-1800 p.s.i., depending on the setting of the inbuilt relief valve. The pump delivers three gallons a minute output at 1700 r.p.m. and 1000 p.s.i.

GEORGE D. NICHOLS, chief engineer, National Lift Company, Subsidiary Gar Wood Industries, Inc.

Weighing but 18 pounds, the compact unit—pump, valve and clutch—takes up just a 7x7x6 inch space. It mounts on a truck or tractor engine with a bracket that fits on the head by removing two head bolts and inserting the bolts through the bracket holes. This mounting keeps the pump free of splashing water and road dust, the major causes of wear to power take off operated units.

ELIMINATES POWER TAKEOFF SHAFT

The pump is engaged by the all-metal expanding clutch only when power is required. The clutch is within the fan-belt driven pulley, which idles freely on life-time sealed ball bearings when the clutch is not engaged. Once installed, the clutch needs only a few periodic minor adjustments a year that take only a few minutes. The clutch is unaffected by dirt, grease or oil.

Fan-belt drive not only is highly efficient but eliminates the need for a power take off unit and a drive line to pump. Further savings result because the PTO opening (an optional extra cost item) can be omitted on standard transmissions and trucks with automatic transmissions require no auxiliary transmission.

The pump has a sandwich-type assembly to permit

Here's help in

ORDERING HYDRAULIC VALVES!

Use the form below to get specific information, prices, circuit designs and other data you may need on hydraulic valves.

Rivett catalogs 190 standard models in all popular sizes, types, actions, piston designs and pressures. Nearly any hydraulic valve requirement you may possibly have can be filled by Rivett. And Rivett's Factory Engineers and experienced Sales Representatives will assist in planning the most efficient circuits for your operations.

We are interested in the Hydraulic Valves checked below.

☐ Send complete literature and specifications. ☐ Send quotations on items checked. ☐ Have our Rivett Representative call and supply circuit information. ☐ Our specific hydraulic problem is:_____

Mail This Form Today. Or File For Future Use!

RIVETT LATHE & GRINDER, Inc.,
Fluid Power Division
Dept. AH-9 Brighton 35, Boston, Mass.

☐ Hand
- Operation:
  - ☐ Threaded Stem
  - ☐ Lever
  - ☐ Knob
- Action:
  - ☐ Manual
  - ☐ Spring
  - ☐ Ball Detent

☐ Cam

☐ Foot

☐ Direct Solenoid Operated
- Mounting:
  - ☐ Pipe
  - ☐ Sub-Plate
- ☐ Double Solenoid No Spring
- ☐ Single Solenoid Spring Return
- ☐ Double Solenoid Spring Centered

☐ Solenoid Pilot Operated
- Mounting:
  - ☐ Pipe
  - ☐ Sub-Plate
- ☐ Double Solenoid No Spring
- ☐ Single Solenoid Spring Return
- ☐ Double Solenoid Spring Centered

☐ Oil Pressure Operated
- ☐ No Spring
- ☐ Spring Return
- ☐ Ball Detent
- ☐ Spring Centered

☐ Air Pressure Operated
- ☐ No Spring
- ☐ Spring Return
- ☐ Spring Centered

☐ Oil Pilot
- Mounting:
  - ☐ Pipe Line
  - ☐ Base
  - ☐ Foot
  - ☐ Panel

☐ Flow Control

☐ Check
- Mounting:
  - ☐ Pipe
  - ☐ Flange
- ☐ Spring Loaded
- ☐ Pilot Operated
- ☐ Pilot Operated with Pressure Breaker

☐ Shut Off

☐ Deceleration

☐ Relief

☐ Unloading

☐ Sequence
- ☐ Direct Operated
- ☐ Remote Operated
- ☐ With Integral Check

☐ Counter-Balance

Sizes
☐ ¼, ☐ ⅜, ☐ ½, ☐ ¾, ☐ 1, ☐ 1¼, ☐ 1½

Pressures
☐ 1500 P.S.I. ☐ 3000 P.S.I.

Specify Valve Action Desired
_____
_____
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NAME_____ TITLE_____

COMPANY_____ CITY_____ STATE_____

RIVETT furnishes a complete power package

VALVES • CYLINDERS • POWER UNITS
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All sizes and types

Prevent
Sludging
Pump, valve and piston failures
with
HILCO
HYFLOW OIL FILTERS
• STRAIGHT MICRONIC FILTERING
OIL RECLAIMERS
For FILTRATION
Plus WATER and MOISTURE REMOVAL

Oil contamination is one of the largest single causes of hydraulic equipment failure. Eliminate dirty oil with HILCO Purification . . . keep your oil clean by removing products of oxidation, acids, sludge and moisture. Increase the life of your oil and cut costly downtime with HILCO Purification.

Years of experience and dependable service make HILCO your best filter buy.

★ Recommendations at No Obligation
FREE Descriptive Bulletin

THE HILLIARD CORPORATION

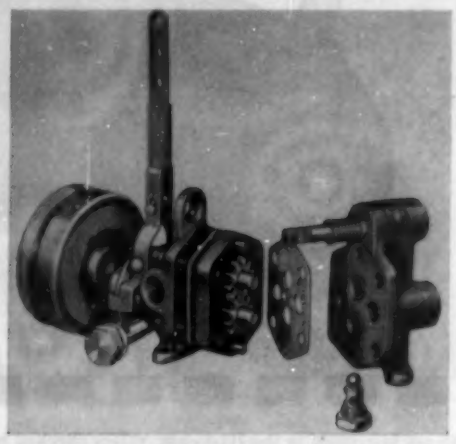
IN CANADA: — Upton - Bradeen - James, Ltd.
890 Yonge St., Toronto — 3464 Park Avenue, Montreal

FAN BELT DRIVEN HYDRAULIC PUMP

close manufacturing tolerance for efficient operation, high interchangeability of parts and easy maintenance.

Replaceable wear plates on each side of the pump gears eliminate wear to pump body or gears. Wear plates can be replaced after long use to restore the pump to original efficiency. Metal-to-metal fitting eliminates gaskets, shims and difficult hand fitting. Pump repairs are made easily by the average mechanic in the field.

The control valve is built into the pump. A single dash mounted control knob gives instant clutch and



CLUTCH MECHANISM operated by a push-pull lever starts and stops the pump. The built-in selector valve is controlled by the same lever.

valve response. Pulling the knob starts pump action. When the knob is released, a spring releases the clutch and a ball check prevents reverse oil flow. Pushing the knob in allows oil flow to reverse.

It appears that fan-belt driven pumps will solve many operating problems and economies in the truck and tractor field. The small size and weight of the pump, coupled with efficient and economical operation, extends the potential application to all types of hydraulically-operated equipment.

ORGANIZATION AND FUNCTIONS OF THE AIA

The Aircraft Industries Association of America, Inc., the national trade association of the manufacturers of aircraft, engines and accessories, parts and materials used in the construction and operation of aircraft, has issued a booklet, "The AIA . . . It's Organization and Functions", outlining the operation of AIA and the methods by which the association approaches the cooperative solution of government and industry in aircraft design, development and production.

The work of AIA is carried out through seven Services and 23 committees, ten committees in the Industry Planning Service and 13 in Technical Service. Functions of such committees as Aircraft Technical Airworthiness Requirements, Aircraft Research and Testing and National Aircraft Standards Committees are detailed.

Copies of the booklet may be obtained from AIA, 610 Shoreham Bldg., Washington 5, D. C.

***finished* part cold-extruded in one piece**

Let Mullins Koldflo produce your ideal designs at *less cost!*

PRECISION steel parts like this can be *mass-produced*—at less cost—by the new Mullins *Koldflo** process. These extrusions are finished—no machining or fabricating required. Now, with fewer manufacturing limitations, you can design cylindrical parts the way you *want* them—without compromise. If you require precision parts, in high volume, call the nearest Mullins office today for engineering appraisal. Write for your copy of the new 16-page bulletin, *"How Would You Tool-up to Make an Egg?"*

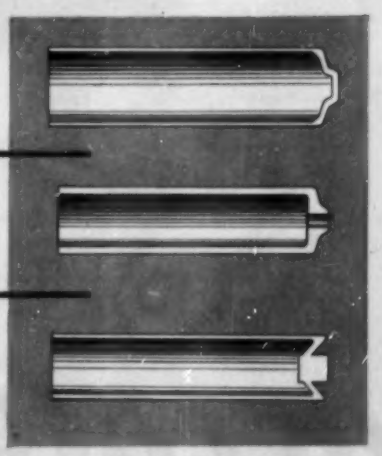
*Trade Mark

Here is what designers say about Koldflo extrusions:

Pump manufacturer says:
"Surface finish and tolerance on our main pump body are critical. Your cylinders meet specifications at lower cost."

Auto manufacturer says:
"Our application involves high pressures. One-piece Koldflo extrusions provide assurance of required strength, at a saving."

Steel products manufacturer says:
"Surface finish, close tolerance and low cost all important. Your design meets our requirements."



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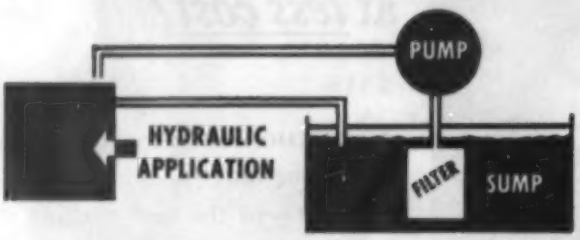
DIVISION
MULLINS MANUFACTURING CORPORATION
Salem, Ohio

Phone — Salem 8771

STAYNEW HYDRAULIC FILTERS

HELP PREVENT ABRASIVE ACTION

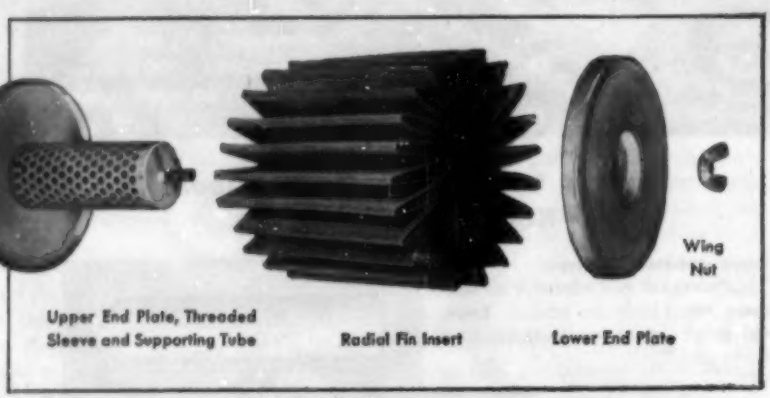
SAVE 3 WAYS WITH *STAYNEW FILTERS* ON YOUR HYDRAULIC EQUIPMENT



The Staynew HE Hydraulic Filter is a compact, simplified, efficient unit for use wherever dirty liquids are collected, filtered and re-circulated. Its unique radial fin design permits the largest possible active filtering area in the smallest possible space . . . and actually saves three ways:

1. Saves unnecessary wear on costly pumps and other equipment by preventing intake of abrasive particles.
2. Saves spoilage and rejects at point of use by insuring clean, clear liquid.
3. Saves man-hours wasted while new machines are being installed or old ones repaired.

MODEL HE
Hydraulic Filter



Entire unit may be disassembled in 30 seconds merely by unscrewing wing nut at bottom and drawing out Radial Fin Insert. *Insert may be cleaned with solvent or brush in a matter of seconds.* It is not necessary to remove the filter from the line to take out the Insert.

Send your filtration problems to Staynew. Models available for complete range of sizes and capacities at low cost. Write for Bulletin HF-2 today.

Representatives in Principal Cities

DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

DOLLINGER CORPORATION

65 Centre Pk., Rochester 3, N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

Circle 30 on Reader Service Card

Special Features in the October NCIH Issue

The October issue of APPLIED HYDRAULICS will carry a number of special features on the Tenth Annual National Conference on Industrial Hydraulics and on the 1954 Prize Paper Contest as well as a lineup of outstanding regular articles written especially for this issue.

This issue will carry a complete program of the Tenth NCIH including chairmen and panel members of the various technical sessions. Abstracts of papers to be delivered will also appear.

In October we will announce the entire group of winners of the 1954 APPLIED HYDRAULICS Prize Paper Contest. Both the cash prize winners and the entries awarded honorable mention will be listed. The three major prize winners will be on hand to accept their awards in person. The presentation will be made at one of the luncheons of the NCIH.

The first prize winning paper and two other prize papers will be published in a special 16 page form in this issue. The special section will also carry comments by the 1954 judges.

The third special feature in October will be a group of three articles on hydraulic training programs. One of these is the initial course in Oil Hydraulics at Illinois Institute of Technology and the other two are in-plant training programs.

Regular features for the October issue will include "Back Pressure—How it Affects Valve Operation" by John J. Pippinger, Vice President, Double A. Products Co.; "Safe Cut-Off Control" by Wesley Grotewohl, The Ross Operating Valve Co.; "How to Change a Geared Planer Drive to Oil Power" by William J. Endicott, Craig Machine Co.; and "Oil Power Robot Does the Work of Many Hands" by Bruce Barton and Jack Grimm, The Hautau Engineering Co.

In addition to copies of the October issue, our display table near the registration area at NCIH will have the first copies of the reprint "Beginner's Course in Basic Pneumatics".

LET US QUOTE ON YOUR TUBING AND FABRICATION NEEDS

Avon single wall steel tubing is successfully supplanting other types of tubing—aluminum, brass, copper and steel—with equal or improved reliability of performance and really impressive economies.

Avon's High Frequency Fusionweld process insures a much higher degree of tensile strength, greater resistance to vibration and fatigue, extreme ductility, plus greatly improved adaptability in producing the most critical tube forms—such as beading, bending, coiling, flaring, knurling, slotting, piercing, threading and swaging without cracking, tearing or checking.

Avon engineers can assist with your tubing problems and help point up cost saving advantages. Why not write, or submit blueprints for quotations.

⅛" O.D. to ¾" O.D.
PLAIN OR TERNE COATED

A few of the hundreds of Fusionweld Tubing applications

AUTOMOTIVE
Gas lines & vents
Brake lines
Hydraulic window & seat lifts
Chassis tubes
Radiator overflow
Choke controls
Oil return lines
Dip stick tubes
Oiler tubes
Automatic transmission

FARM EQUIPMENT
Hydraulic lifting devices
Support tubes
Lubrication lines
Fuel lines
Fuel manifolds

ELECTRICAL
Ceiling & wall fixtures
Lamp tubes
Heating elements
Radio & TV antennae

HEATING
Oil & gas lines
Pilot tubes
Flash tubes
Pot burner tubes
Fuel tank tubes

TOYS—FURNITURE
Scooter & wagon parts
Spacers
Pop guns
Bicycle parts
Mechanical toys
Tables
Chairs
Swings
Baby carriages, cribs, car seats and beds

MISCELLANEOUS
Umbrellas
Display boards
Panels
Conveyor oil lines
Lawn mower handles
Hose reels

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HIGBIE MANUFACTURING CO.

ROCHESTER MICHIGAN

tough, flexible **CaPlugs** insure dirt-free arrival of Alemite Accumeter Valves

Furnished as a key component of an Alemite Accumeter Centralized System for machine lubrication, this tiny, accurate valve must be kept dirt and grit-free during shipment . . . *and it is!* Easily-applied Tapered CaPlugs seal all three openings.

Says Stewart-Warner Corp., manufacturer of Alemite Systems, "All of our equipment that is tested on the assembly line is capped or plugged with CaPlugs. . . . They also help impress the customer with the steps that have been taken to protect the equipment and convince him of the continuing need for protecting lubricants against contamination."

Molded of tough, flexible Polyethylene, CaPlugs are impervious to all common chemical reagents, acids and solvents. They will not chip, break or shred under most severe conditions.

Furnished in five standardized designs, CaPlugs are stocked in over 100 sizes to meet most requirements. Write for catalog, price lists and free CaPlug assortment.

CaPlugs

DIVISION

PROTECTIVE CLOSURES CO., INC.

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TAPERED CAPLUGS For use as caps or plugs, inside or outside of threaded or plain fittings.

SC SERIES Thread-protecting dust caps for electrical connectors. Fit over threaded or plain fittings.

CD SERIES Threaded seal and shipping caps. Knurled for ease of application.

PD SERIES Threaded Plugs for aircraft and hydraulic tube fittings. Seal beyond ordinary requirements.

NEW SERIES SC SLEEVE CAPS NOW AVAILABLE

Hydraulic Noise in Vane and Piston Pumps

Concluded from page 68

operating at the same speed for the same volume of flow. The comparison can only be made by plotting the theoretical pressure changes in the discharge port due to the periodical flow rates from each of the two and observing the slope of this curve. This slope will be a function of the change in pressure occurring as a result of this type of flow. Such an analysis, with theoretically perfect filling, will indicate that the overall variation in pressure in the three-piston pump will be greater than that in the five-piston pump, but it will also indicate that the time during which this variation occurs is correspondingly greater. Since noise is a function of the time rate of pressure change, this tends to equalize the possibility of noise production from this source in both units.

In the various qualitative studies the author has made of this particular phenomenon, it has seemed evident that any real production of noise from this source has resulted from the particular configuration of the pipe lines, cylinders, containers, etc., that act as the receiver of the flow from the unit. Under certain conditions the receiver could act as an amplifier for this pressure change and, in such way it may become significant. Since such amplification requires a certain kind of tuning with the frequency of the pressure pulsations in the system, if such amplification occurs, it is usually quite simple to change the discharge line volume enough to eliminate it. Since the power unit to be driven by a hydraulic pump usually functions better if it is fed with the desired pressure at a constant rate, it is usually true that by the time pressure pulsations of this character have been smoothed enough to make for good performance of the driven unit, the noise created from this source has been automatically minimized.

National Metal Congress and Exposition to Meet in Chicago

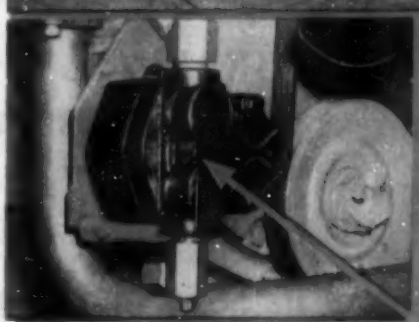
The 36th Annual National Metal Congress and Exposition will be held the week of November 1-5 in Chicago. The Exposition will be held in the International Amphitheatre; the Congress or technical sessions at the headquarter hotels of the participating societies.

Sponsored by the American Society for Metals and participated in by three additional technical societies: the American Welding Society; Institute of Metals Division, American Institute of Mining and Metallurgical Engineers; and the Society for Non-Destructive Testing, the 1954 Exposition will be the largest of the nine shows held in Chicago. A total of 444 firms have reserved 263,000 square feet (over 6 acres) for the display of equipment, products and services in the metal producing and metal fabricating field.

Each society will hold their own series of technical meetings through the week, as many as possible being scheduled at other than show hours.

"We save 2 ways with WEBSTER PUMPS"

From an interview with L. D. Hoffman, Chief Engineer, Service Caster & Truck Corporation, Albion, Michigan recorded by a WEBSTER EKOTAPE



S4024 4000-lb. fork lift truck, made to U. S. Navy specifications for the Army by Service Caster & Truck Corp., is equipped with a WEBSTER Hydraulic Pump

Here you see how the type HC WEBSTER pump is attached for direct drive from engine of Service Caster-built fork lift truck

says Service Caster & Truck Corporation

"The WEBSTER Hydraulic Pump has been very satisfactory. It is easy to install because the drive gear is an integral part of the pump drive shaft. This is an economy feature; we save time installing the unit, and eliminate the problems of a keyed assembly.

"Another reason we use the WEBSTER pump is that it is lower priced than most of the others available for this particular installation. It helps us get the contract.

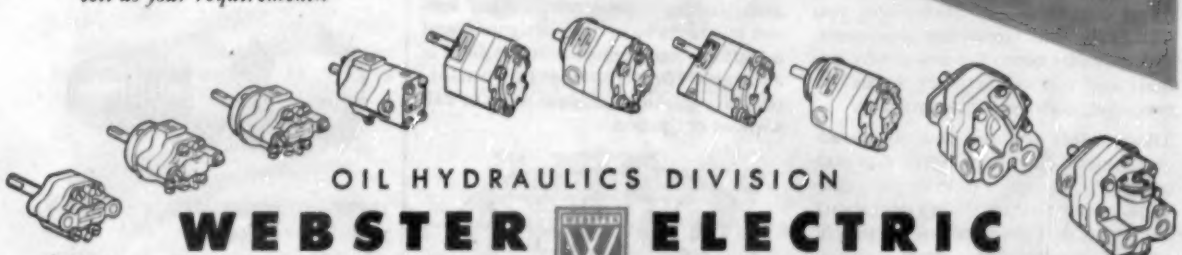
"This WEBSTER Hydraulic Pump compares favorably with the pumps that we've used previously . . . and saves us money two ways."

Choose from WEBSTER'S 90 types

The type HC WEBSTER Hydraulic Pump used by Service Caster is but one of 90 types of positive displacement gear pumps with capacities from ⅙ gpm to 30 gpm—at pressures up to 1200 psi—speeds to 3600 rpm—with or without relief valves—for sealed or wet sump mounting.

One of these custom-built units may well be the answer to your particular application. They are highly adaptable to a wide variety of uses in oil hydraulic systems.

***Write** us today for a catalog which contains illustrations, descriptions, performance charts, and pump data sheets on which you can tell us your requirements.*



OIL HYDRAULICS DIVISION

WEBSTER ELECTRIC

RACINE, WISCONSIN

ESTABLISHED 1909

"Where Quality is a Responsibility and Fair Dealing an Obligation"

MANUFACTURERS OF A COMPLETE LINE OF OIL HYDRAULIC PUMPS

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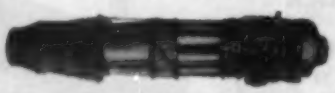
GENERAL ELECTRIC

PRATT & WHITNEY

WRIGHT AERO



ALLISON

WESTINGHOUSE

A. V. ROE

NATURALLY...
the greatest names in jets test with

GREER

the greatest name in test equipment

WALK INTO THE PLANT of any leading jet engine manufacturer and you will likely find Greer test equipment. Ask a quality control engineer why it is there and you will get back words like *precision, accuracy, dependability.*

These words will tell you, as no advertisement can, that Greer has succeeded in its goal – to take the guesswork out of aircraft testing operations. Today, with Greer, testing is simple, rapid, dependable, absolutely accurate.

Greer's standard testing equipment fills the pages of a 26-page catalog (write for it on your letterhead). To meet unusual testing requirements, many special machines have been designed – and a staff of top engineers in the field is available for discussions of out-of-ordinary problems. Please write or call without obligation.

GREER TEST EQUIPMENT

GREER HYDRAULICS INC. • International Airport • JAMAICA 30, NEW YORK
Field offices in Chicago, Dayton and Detroit • Sales Representatives in all principal cities

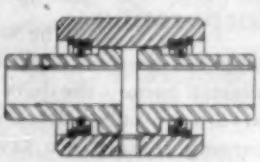
NEW PRODUCTS

Continued from page 43

TRI-LOBE COUPLING
. . . for torsional strength

Sizes: Standard sizes up to 5 in

Design: Universal coupling designed with a equilateral tri-lobe shape in its driving members. The tri-lobe shape is composed of a combination of radii and is void of tangent flats. An accurate profile of the periphery of



male members provides angular rotational displacement.

Features: 8 degree rotational displacement; driving members are self-centering under all loads, thereby eliminating eccentricity problems associated with universal couplings; engagement between male and female members held to maximum .0002 in side clearance; working surfaces finish ground maximum 10 mu in rms.

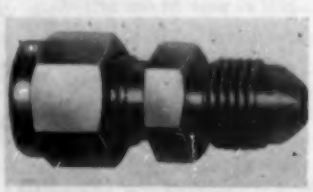
Kerns Manufacturing Company, Long Island City 1, New York
Circle 208 on Reader Service Card

FLARE CONNECTOR
. . . is leak-proof

Designation: Swagelok

Sizes: Range from ⅛ in to 1 in

Feature: Switching easily accomplished from flare fittings with these connectors, which are satisfactory either for testing or permanent installations. The



threaded end conforms to AN standards. Opposite end incorporates a principle of design which results in torque free, leak-proof seals.

Crawford Fitting Company, Cleveland 10, Ohio
Circle 209 on Reader Service Card

PLASTIC LEAD SEAL
. . . is non-hardening

Size: 1 lb brush top can

Features: Plastic lead seal pipe thread and gasket sealing compound provides a permanent type applicator, always at hand for immediate use. The need for cleaning the applicator after each use is eliminated. Other advantages of the new applicator are the brush which permits working the compound more

thoroughly into the threads, the flat shank from which excess compound can be easily removed without waste, and the fact that it extends to the bottom of the can to enable full use of the contents.

Applications: Non-hardening sealing compound which allows easy disassembly of connections, even after years of service. Withstands pressures up to 6000 psi, temperatures to 500 F and is insoluble in water, steam, gas, refrigerants and all petroleum products.

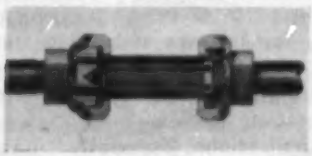
Crane Packing Co.,
Chicago 13, Illinois

Circle 212 on Reader Service Card

AUTOMATIC FLOW SWITCH
. . . safeguard for equipment

Designation: Shur-flo Automatic Interlock

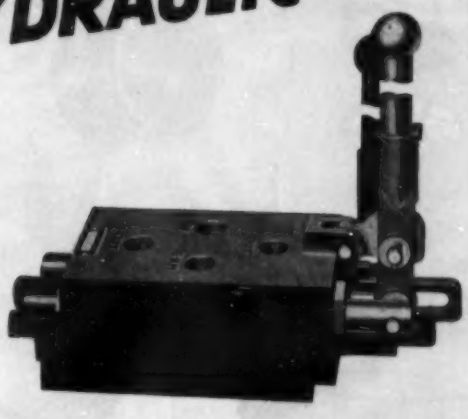
Size: Available in ⅛ in and 1¼ in pipe sizes. The ½ in provides



switch control points anywhere from .1 gpm through 8 gpm and the 1-¼ in from 8 gpm through 40 gpm. Any contact point de-

Quick-As-Wink®

HYDRAULIC VALVES



Hand Lever and Pilot Cylinder Types—pressures to 5000 psi.

Have won industry wide recognition

for unsurpassed dependability

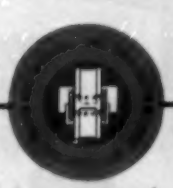
● Positive and fast acting, Quick-As-Wink Control Valves are designed and built to meet the most exacting requirements. Bodies of hydraulic valves are either forged or milled from solid bars. The hollow, radially ported, stainless steel plungers are chrome plated and polished to minimize wear. All parts are readily accessible and maintenance—that consists mostly of the very occasional replacement of the packing — can be done easily **in the field** without even disconnecting the piping. This avoids the necessity of returning valves to the factory for servicing or maintaining large standby inventories. Let us recommend the sizes and types that will meet your requirements best. Write for Bulletin 531. It gives full details.

Ask us also about . . .

DOUBLE PILOT CYLINDER HYDRAULIC VALVES operated with air or hydraulic pilot cylinders—3 position; neutral, compound-on or compound-exhaust.

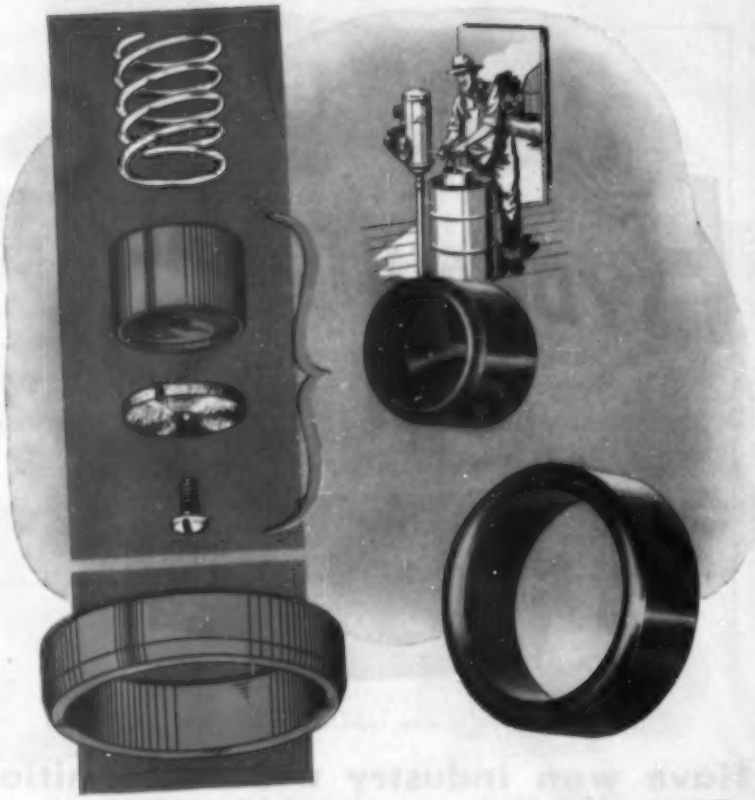
DOUBLE SOLENOID "O-TYPE" VALVES for pressures up to 125 psi. Widely used as pilot valves and for operating air cylinders.

Quick-As-Wink
AIR AND HYDRAULIC
Control Valves



Hand, Foot, Cam, Pilot, Diaphragm and Solenoid Operated

Mfd. by C. B. HUNT & SON, INC., 1995 East Pershing St., Salem, Ohio



How G&K-INTERNATIONAL helps The Lerio Corporation cut costs by replacing machined metal parts with *molded* synthetic rubber

In the Lerio Automatic Water Pump suction is formed by two pistons operating within a small galvanized steel tank.

Discharge valve body in each piston head was formerly of brass, machined to seat a spring and retain a washer held in position with a screw. Seat in the foot valve assembly was formed from brass tubing and required three turning operations.

G&K-INTERNATIONAL engineers developed a simple cup-shaped valve body and a seating ring molded of synthetic rubber. Results: much quieter operation, and real savings in manufacturing cost and assembly time.

G&K-INTERNATIONAL is ready to work with your engineers to develop molded synthetic rubber or impregnated leather parts which may offer savings to you.

Write for G&K-INTERNATIONAL Catalog and Manual 201-A. 60 pages of up-to-date data including latest JIC and officially recommended sizes for cups, flanges, U's, V's, O-Rings — also facts on all seals and specialties.

G&K-INTERNATIONAL *Packings*

GRATON & KNIGHT LEATHER — SYNTHETIC RUBBER

GRATON & KNIGHT COMPANY, Worcester, Massachusetts
INTERNATIONAL PACKINGS CORPORATION, Bristol, N. H.

P-4

New Products

Continued

sired is provided by changing the orifice size in the control.

Features: Operates by means of a differential of pressure across the orifice. Protects equipment requiring a definite flow of fluid to assure proper operation and prevent damage. Will cut off equipment or provide a signal wherever flow falls below the established safety rate.

Industrial Sales Division, Hays Manufacturing Company, Erie, Penn.

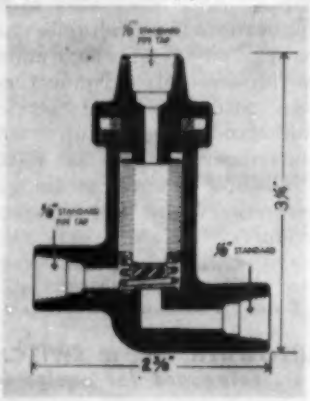
Circle 213 on Reader Service Card

PACKLESS BELLOWS VALVE . . . for vacuum, high pressure systems

Size: Inlet and outlet fittings are ⅛ in female pipe tap.

Design: The pneumatic-hydraulic operated model operates on line pressures of 10 to 150 psi. The valve seat is spring loaded to insure positive opening action when actuating pressure is released.

Construction: The all metallic construction eliminates the use of sliding or restrictive packings, insures a positive leak



tight seal and minimizes wear and deterioration. The hand operated valve features a ball joint in the handle which prevents torque from being transmitted to the bellows and valve stem so that the valve is seated by a straight vertical thrust with no rotating motion.

Applications: Especially suitable for high vacuum systems such as laboratory equipment, exhaust systems for hermetically sealed products such as elec-

tronic equipment or aircraft components mass spectrometers and similar service. The pneumatic-hydraulic model is well suited for multiple manifold set ups and remotely operated valves.

Clifford Manufacturing Company, Waltham 54, Mass.
Circle 214 on Reader Service Card

FITTING AND HOSE
. . . uses no clamps or sockets

Sizes: ¼ in and ⅜ in, in the kit, and up to ⅝, in bulk stocks
Design: Fitting and hose combination need no clamps or sockets. Hose is just pushed on the fitting and the effect of pressure is to make an even tighter grip.
Features: The merchandiser includes 17 popular fitting sizes

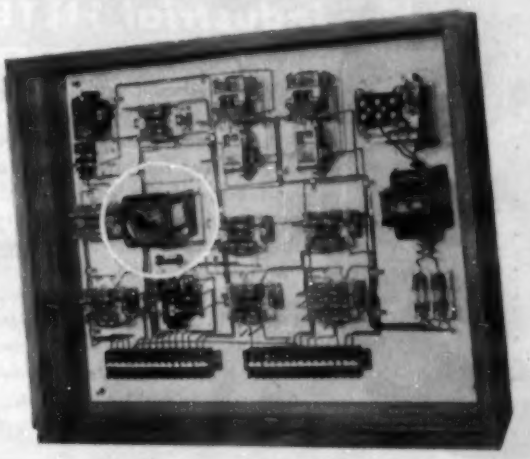
and 24 feet each of hose in both the ¼ in and ⅜ in sizes. Ease of assembly is an important feature of the socketless hose lines but a real advantage to automotive service businesses will be reductions in inventory made possible by dispensing with costly stocks of ready made hose lines.
Applications: May be used for all and medium pressure fuel, air, water and oil lines.

Aeroquip Corporation, Jackson, Mich.
Circle 215 on Reader Service Card

ABSOLUTE PRESSURE TRANSDUCER
. . . provides control functions

Designation: Type P-1
Design: Provides an absolute pressure sensing element with good resistance to pressure shocks and high accuracy throughout an extremely long life. Linkage and motion is used to produce a phase sensitive emf.

Automation
STARTS WITH
EAGLE Timers
FOR ANY SIZE INDUSTRY
WELDING



The Eagle Cycl-flex Reset Timer meets the specific requirement needed for more flexible control of the Peck Automatic Welder. The Cycl-flex with its flexible time and electrical control features made it the ideal timer for regulating the proper "overlap" and "arc cutoff" phases of the cycle. The timer is easy to set — easy to read — it has cycle progress indication.

Eagle builds timers for controlling hundreds of processing applications. Let Eagle engineers go to work for you.

Send for FREE Automation Booklet "See what timing can do for you?"

Industrial Timers by EAGLE

EAGLE SIGNAL CORPORATION MOLINE, ILL.

Keeps Oils Clean

EVEN WHEN SYSTEMS AREN'T DRAINED FOR A YEAR!

GENERAL AF-500 *Industrial* FILTERS

Keeping hydraulic and lubricating oils free from impurities can be a costly process — one demanding the frequent draining and refilling of entire oil systems. But with the GENERAL AF-500's positive absorption . . . moisture, dirt, rust, tars and lint are *safely trapped* in the finest wool felt, assuring trouble-free, uninterrupted operation of oil systems for as long as a year! Machine parts are protected from abrasive wear and maintenance costs are reduced on both new and old equipment.

No other Filter like it!

TWO-FOLD ELEMENT

The AF-500 actually works two ways — its ALL-WOOL felt element traps *moisture* and dirt particles as fine as 5 *microns*.

CLEAN, SAFE LIQUIDS

Clean, completely dependable oils, paints, lacquers and other industrial liquids are assured at 15-20 gpm, depending on viscosity.

LONGER MACHINE LIFE

Both on new and old equipment, GENERALS protect vital machine parts from abrasive wear, greatly prolonging service life.

SIMPLE DISASSEMBLY

Cleanable wool felt cartridge can be quickly removed and washed in any suitable solvent without disturbing inlet or outlet lines. Merely unscrew center bolt, lift off cover and two washers, and remove felt cartridge intact.

WRITE us — without obligation — about your industrial filtering problems.

GENERAL FILTERS, INC.

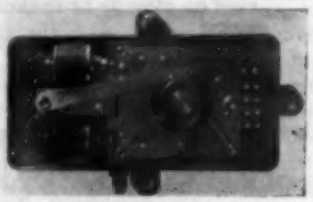
43800 GRAND RIVER AVENUE • NOVI, MICHIGAN
CANADIAN GENERAL FILTERS, LTD., 2479 DANFORTH AVENUE
TORONTO 13, ONTARIO

New Products

Continued

proportional to the pressure applied to the unit. This general principle may be adapted to motivate other signal sources such as potentiometers, variable capacitors, variable inductors.

Construction: Non-corrosive materials; unit is housed in a



drawn aluminum case with removable cover; flare fitting for ¼ in tubing provides for pressure line connection and electrical connections are made through a ½ in knockout to a terminal block enclosed in the unit or through an AN-3102-14S-2P receptacle.

Applications: Recording, indicating and controlling of gas or liquid, pressures and vacuum.

E. V. Naybor Laboratories, Port Washington, New York

Circle 216 on Reader Service Card

DIRECTIONAL VALVES . . . for automatic machines

Designation: Hi-Cyclic Manifold Mount

Design: For automation or other control set-ups where precise control is vital. Manifold construction permits rapid replace-

ment of all critical parts, including the valve body and spool assembly, without disturbing the piping or the main manifold block. There are no valve packings. Seal is obtained by precision fit. All materials used are

corrosion-resistant and the materials in contact with the medium are bronze and stainless steel. Solenoids used on electrical models are continuous duty type. An adjustable flow control is built in on all air valve models. The manifold seal is by standard "O" ring.

Construction: Electrical valve models have a built-in junction box and quick-disconnect electrical connections. Solenoid coils can be removed without disturbing the electrical circuit. All electrical leads are channeled from a ½ in size conduit outlet located at the base of the valve.

Applications: For air or other non-corrosive gas, and oil or water hydraulics. Types include 3-way, 4-way, two or three position, in nominal NPT sizes. Actuators include single solenoid, double solenoid, piloted, hand lever, fingertip lever, cam roller.

Beckett-Harcum Company, Wilmington, Ohio

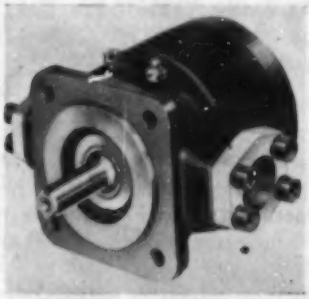
Circle 217 on Reader Service Card

HYDRAULIC PUMP

. . . improves space to hp ratio

Designation: PF-100 series

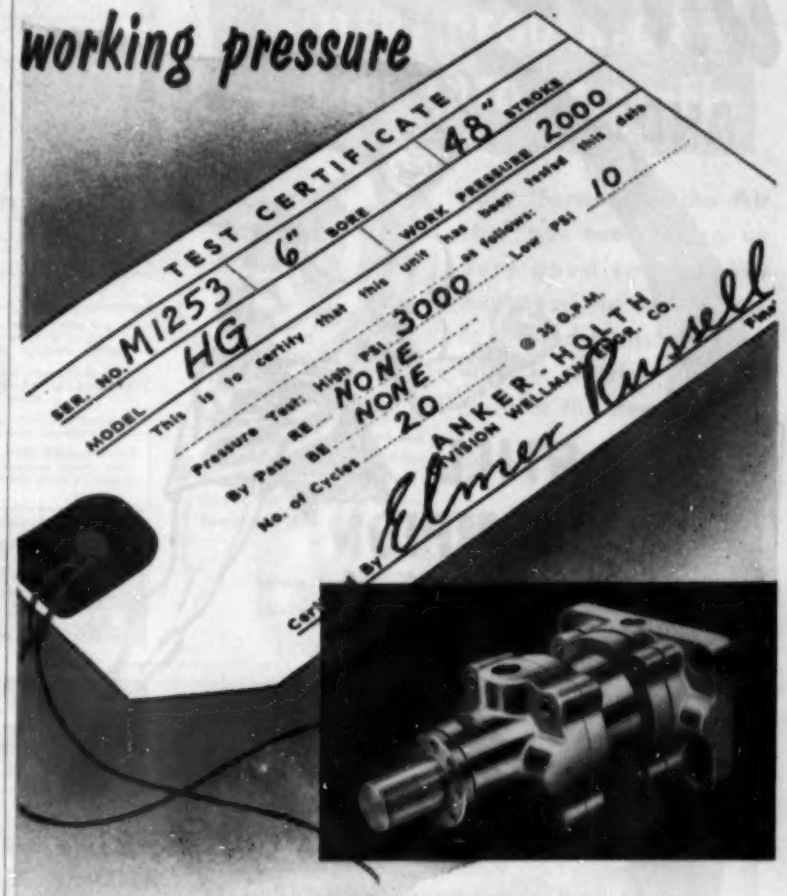
Construction: Simplified 3 unit construction makes it possible to disassemble the pump for inspection or change a pumping cartridge in the absolute minimum of down-time. SAE solid



and split flanges permit fast, easy removal of the pump without disturbing existing piping or tubing.

Features: Allows approximately twice the horsepower in the same space. All pumping parts that move are contained within a cartridge. After long service a new pump can be provided for the price of a new cartridge. If power requirements of system change, pump output can be made to match by changing car-

Every Anker-Holth Cylinder is certified at 1½ times working pressure


TEST CERTIFICATE
SER. NO. M1253
6" BORE
48" STROKE
MODEL HG
WORK PRESSURE 2000
This is to certify that this unit has been tested this date
Pressure Test: High PSI 3000 Low PSI 10
By Pass RE NONE
By Pass BE NONE
No. of Cycles 20
@ 35 G.P.M.
ANKER-HOLTH DIVISION WELLMAN ENG. CO.
By Elmer Russell

This safeguard of dependable performance is yours when you SPECIFY ANKER-HOLTH CYLINDERS

• Each Anker-Holth Cylinder is tested at 150% of working pressure with the latest completely-filtered testing equipment. A tag such as shown above certifies to its satisfactory performance under these above-normal operating conditions.

This is another reason why it pays to specify reliable Anker-Holth Cylinders. Call or write for engineering help on your problems in power motion. ANKER-HOLTH DIVISION of The Wellman Engineering Company, Department C-15, 2723 Conner Street, Port Huron, Michigan.

Write for bulletin on complete line of ANKER-HOLTH products.

Anker-Holth

ENGINEERED CYLINDER POWER

Division of THE WELLMAN ENGINEERING COMPANY

UNDEFEATED!

AND

STILL CHAMPION

CAN YOU SUPPLY A CHALLENGER?

. . . That difficult fluid, gas, or air transmission problem in your plant—We'll send you a Snap-tite Hi-Flow quick connect disconnect coupling with or without automatic shut-off in any size 1/8" to 3"—Test it in your plant, under actual working conditions—You be the judge—If it doesn't solve your problem or do a better job than the coupling you are now using, ship it back collect—Write today on your letterhead, briefly outlining your problem—We'll ship immediately.

Snap-tite INC.

201 S. Rockwood, Union City, Penna.

New Products

Continued

tridge or cam ring. Provides multiple fluid seals which reduce slippage to the minimum and permits greater loads at pressures ranging from 1000 psi to 3000 psi. Full balance of pressure loads gives longer pump life and maintenance free operation.

Dudco Division,
The New York Air Brake Co.,
Hazel Park, Mich.
Circle 218 on Reader Service Card

ROTARY BENDING MACHINE
. . . bends right and left hand

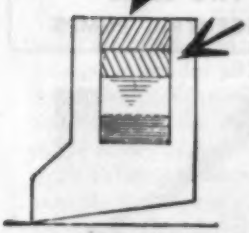
Designation: No. 800-2"
Capacity: 2½ in OD x .065 wall steel tubing, or 1½ in standard pipe.
Design: Self contained for production or custom bending applications. Dual controls for operator's convenience, ample clearance for bends on more than one plane.
Construction: Built entirely from welded steel sections, electrically arc welded. Motor, pump and storage tank are in the base of the machine. A 5 hp motor is included that can be wired for 220 or 440 volts, 3 phase, 60 cycle ac. Has no clutch, no brake or reversing motor.

Operation: Machine bends to 180 degrees, both clockwise and counter clockwise. Bending head has approximately 8 rpm. Mandrel clearance of 8 ft, 6 in. A degree of bend dial is mounted on the head. The clamp and pressure dies are brought into proper position by means of toggle levers. Forward and reverse rotation of the bending arm is controlled by a single hydraulic valve. A separate hydraulic valve controls the in and out mandrel movement.

Wallace Supplies Mfg. Co.,
Chicago 14, Illinois
Circle 219 on Reader Service Card

Circle 1 on Reader Service Card

Cover Band Holds **Spring** automatically in place preventing ring from opening up



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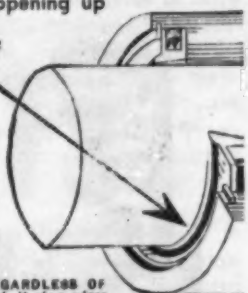


Stops Build Up of Ice, Mud or other Foreign Bodies between Rod and Ring . . .

The wiper edge of the FALL Wiper Ring is TIGHT against the piston rod at all times REGARDLESS OF WEAR. Spring-Loaded, it gives wiper edge a squeeze grip action . . . the squeeze grip is always the same because of the uniform tension of the spring under the endless cover band.

Squeeze Grip Action Does It—*patented*

Ice, grit and other foreign bodies do NOT Build Up under ring. Rod does not stick or become immobile in ANY temperature . . . the FALL ring has complete contact on rod ALL WAYS, always.
Insist on FALL Wiper rings. Available from ½" to 12" dia. Military part numbers from AN6231A1 to AN6231A71. Write, wire or phone us your wiper needs.

Used During World War I and ever since by the Military.
Fall Wiper Rings Spec MIL-S-5049 are AN approved.
Covered by patents issued and patents pending.

Ace Products Co., Toledo 1, Ohio. Phone ADams 6513

Ask About FALL Wiper Rings with Closed Joint Especially designed for those applications where absolute freedom from dirt passing through joint of ring is required.

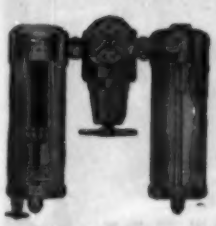
You Can depend on ACE PRODUCTS—Established 1939!

Fall Wiper Ring SPRING LOADED

Circle 79 on Reader Service Card

Prominent User Acclaims

"M-B" Automatic Air Line FILTER, REGULATOR and LUBRICATOR Assembly



The value of "M-B" Automatic Air Line Filters, Regulators and Lubricators is widely known for their effectiveness as a protection to Air Valves, Cylinders, Pneumatic Tools, etc.

"Your 'Sentinel of the Air Line' has been giving us very good service. We have had no complaints at all and I trust that we will be ordering more of them in the near future."

***signed:* A. E. Cranston, Sr.**
PRESIDENT
Cranston Steel Strapping Co.
Oak Grove, Oregon

Write for Literature

M·B PRODUCTS
Division of Tool Sales Co.
46 Victor Ave., Detroit 3

Air and Hydraulic Cylinders

• FOR HEAVY-DUTY APPLICATIONS OF ALL TYPES • TO MEET ALL SIZE AND PRESSURE REQUIREMENTS • BORES TO 60" DIAMETER • STROKES OF 50 FT. AND LONGER

Lincoln Machine Company will design, engineer and build standard or special hydraulic and pneumatic cylinders with trunion, rod-end flange, blank-end flange, foot, clevis or centerline mountings.

Call on Lincoln when you require large, powerful rotating or non-rotating hydraulic and air cylinders, heavy-duty mill-type cylinders. Our engineering department will give you fast, practical assistance in design problems . . . and our modern plant will build your cylinders quickly and economically.

18½" Bore
13" Rod
3000 PSI

Write today for Lincoln's catalog. It gives engineering data on many types and sizes of heavy-duty cylinders.

LINCOLN MACHINE CO., INC.
326 West 2nd Street—Salem, Ohio

here's a 4-wheel solution to your sticky hydraulic valve problem

Removes all contaminants from hydraulic oils—30 to 60 g.p.h. models

the HOFFMAN portable cartridge filter

PROBLEM

How to provide clean, sludge-free oil to avoid sticky valves on hydraulic machines where oil quantity does not warrant individual, continuous filtration?

SOLUTION

The Hoffman Portable Cartridge Filter. Moves quickly and easily—goes anywhere in your plant to protect machines with periodic scheduled filtration. Surprisingly low in initial cost and upkeep, it occupies no fixed floor space, and is easily operated by one man.

FILTERS WHILE MACHINE OPERATES!

Equipped with quick-connecting couplings, the Hoffman Portable Cartridge Filter hooks up to the oil supply of your machine without interrupting operation. In just a short time, the oil is completely recirculated, and made free of damaging abrasives. Hydraulic presses, hydraulic scrap balers, injection moulding machines, and die casting machines are only a few of the applications of the versatile Hoffman Portable Cartridge Filter.

Write today for Bulletin A-916

For complete purification of used oils

HOFFMAN oil conditioner

25 to 600 g.p.h. capacity. Portable or stationary. Removes solubles and insolubles.

Write today for Bulletin A-974

Hoffman

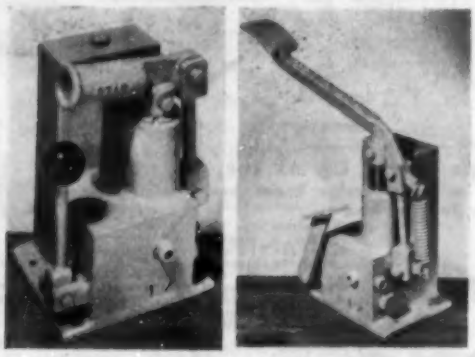
INDUSTRIAL FILTRATION EQUIPMENT & SERVICE

U. S. HOFFMAN MACHINERY CORP., 220 LAMSON STREET, SYRACUSE 6, N. Y.

In Canada: Canadian Hoffman Machinery Co., Ltd., Newmarket, Ont.

Circle 112 on Reader Service Card

STAR Hi-Lo TWO SPEED CONCENTRIC PUMPS



- **HAND AND FOOT OPERATED**
  Two speed construction provides automatic change over during operating cycle from high speed low pressure to low speed high pressure.
- **MAXIMUM CAPACITY 10,000 P.S.I.**
  Safety overload valves—Hard chrome plated pistons—Piston stroke 1½ inch—Oil capacity 150 cu in or larger—3 models (½"-⅞") (½"-1¼") (½"-1½")

Star Jack Co. *River Grove, Ill.*

After two years of research

A **RELIEF VALVE** THAT **DOESN'T LEAK!**

- In-line design
- Adjustability that can't be tampered with
- Excellent flow characteristics
- Precise operating reliability
- Suitable for almost any gas or liquid

Send for information today..... ☐

CIRCLE SEAL *precision valves*

Representatives in Principal Cities.

JAMES•POND•CLARK

2181 East Foothill Blvd • Pasadena 8, California

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Circle 63 on Reader Service Card

Patents (Continued from page 73)

tered the mark and claims its rightful ownership. It is important for all such registered marks to carry this notice for the reason that the trademark laws provide that it is the duty of the registrant to give the public notice of the fact that the trademark is registered. Failure to include this notice with the trademark prevents the recovery of damages for past infringement, except on proof that the defendant was directly notified of infringement and continued the same even after such notice was given.

The subject of copyrights is directed primarily to the finer arts, which are afforded protection against copying by others. Copyrights are not to be confused with trademarks, which merely protect an identifying mark or symbol.

A person desiring to apply for a copyright registration may write to the Register of Copyrights, Library of Congress, Washington, D. C., for information and for the proper copyright form for the particular material for which he wishes to register a copyright. This service, including the information and the copyright form, is free of charge.

GENERAL MISCONCEPTION

There is a general misconception that the copyright proprietor has no legal right to apply this notice of copyright upon his material to be registered until he has obtained the copyright registration. This assumption is incorrect. It is a legal requirement that the notice of copyright be printed upon the material to be copyrighted as of its first publication and before mailing it to the Copyright Office. Unfortunately, when copies have once been published without the copyright notice, there is no legal way of securing a registered copyright for the work. Even the addition of a subsequent publication bearing the correct copyright notice will not cure the defect of a prior publication without such notice.

RIGHTS OF INVENTORS

It should be remembered that the incentive to create for the promotion of industrial progress is greatly stimulated by the assurance that the thing created can be protected as a valuable property right. This protection of the property rights of inventors is fundamental to our industrial growth. In recognition of this fact, the law has characterized patents, trademarks and copyrights as industrial property, which is the source of our greatest wealth. As in the past, the power to invent and create new things will control the future. The extent to which industrial property may grow, though it is beyond our ability to comprehend its vastness, will be proportional to the degree of protection afforded by the laws, and to this extent an even greater emphasis will be placed upon patents, trademarks and copyrights.

This article has been reprinted from "The Clevelander," June, 1954.

IF YOU ARE PAYING FOR FRILLS INSTEAD OF FILTRATION

Specify Bendix-Skinner RIBBON FILTER ELEMENTS . . .

• LOWER ORIGINAL COST
• SIMPLE, INEXPENSIVE TO INSTALL
• NO EXPENSIVE BACK UP SUPPORT REQUIRED
• PERMANENT TYPE
• HIGH FLOW RATE (EITHER DIRECTION)
• EASILY CLEANED

PHENOLIC-RESIN IMPREGNATED CELLULOSE

It seems hard to believe, but you can actually have more efficient filtration at considerably lower cost if you simply use Bendix-Skinner ribbon elements instead of expensive and less adaptable metal edge or metal screen types.

Here's how it works—Bendix-Skinner ribbon elements are inexpensive to begin with and can be installed at far less cost than metallic elements that require special back-up supports. In fact, in practically every instance present metallic-type elements can be changed over to ribbon-type with substantial savings.

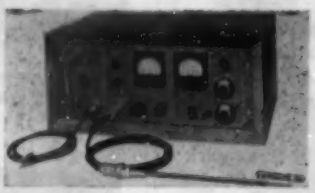
Ribbon units are available in diameters from ⅛" to 6" in any required length with filtration rated at 40 microns (.0016").

Our engineering department will be glad to advise on new installations or to furnish replacement units in a variety of sizes. Write us for details.

Bendix-Skinner
ORIGINATOR OF MICRONIC FILTRATION
BENDIX-SKINNER DIVISION OF Bendix
P.O. BOX 135, ROYAL OAK, MICHIGAN
Export Sales: Bendix International Division 205 East 42nd Street, New York 17, N. Y.

Continued

HOT-WIRE ANEMOMETER
. . . measures fluid flow



Designation: Model HWB
Features: Compact construction, systematized controls, and a wide selection of hot-wire probes for industrial and laboratory applications. The compensated amplifier responds correctly from 2 cps to 100,000 cps and has an equivalent input noise level of ½ microvolt. This noise level corresponds to about 1/100th of 1 percent turbulence level in typical applications. A calibrating signal is provided for direct evaluation of velocity fluctuation magnitudes and for setting the amplifier compensation. Only required accessory equipment is an oscilloscope.

Flow Corporation,
Cambridge, Mass.

Circle 220 on Reader Service Card

Specify Lindberg Air or Hydraulic Cylinders for dependable, low cost power for lifting, forcing, pulling, pressing, pushing and clamping. Lindberg Cylinders feature rotatable heads, self-adjusting piston rod packing, and socket head cap screws.

Ask for bulletin No. 701, "Lindberg Hydraulic Cylinders" . . or No. 732, "Lindberg Air Cylinders."

AIR . . HYDRAULIC
LINDBERG CYLINDERS

Lindberg Engineering Company,
225 No. Laflin Street, Chicago 7, Illinois

DIRECTIONAL CONTROL VALVES
. . . for 2000 psi hydraulic service

Design: Five new valves are designed for use in hydraulic systems with operating pressures up to 2000 psi, all for gasket type mounting. Subplates are available. Designs differ, principally in the methods of actuation. These are, pilot operated, solenoid operated (single or double), and solenoid controlled, pilot operated (single or double solenoid). Solenoid operated valves are rated at a recommended maximum capacity of 3 gpm. Either of two subplates or equivalent mounting pad may be used. One subplate, for flows up to 1 gpm, has ¼ in pipe threads, the other, for flows to 3 gpm, has ⅜ in pipe threads.

Pilot operated and solenoid controlled, pilot operated valves are rated at a recommended maximum capacity of 22 gpm. Subplate is tapped for ¾ in pipe. Pilot pressure may be 50 psi minimum up to 2000 psi valve capacity. Normally the solenoid controlled, pilot operated valves are arranged for internal pilot pressure source. Can be furnished for use with an external pilot pressure source.

Construction: Solenoids are normally furnished for 115 volts,

50 or 60 cycle ac service. Solenoids for other voltages and frequencies can be supplied when specified, including solenoids for dc. A new shock mounting design of ac solenoid is used. Stainless steel push pins eliminate resistance of plain steel pins. All models meet J.I.C. standards.

The Parker Appliance Company, Cleveland 12, Ohio

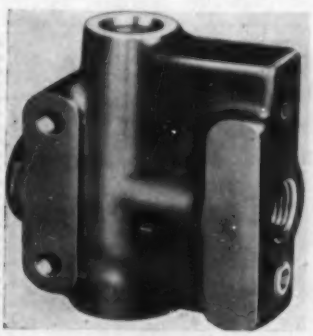
Circle 221 on Reader Service Card

FLOW CONTROL VALVES . . . for power steering

Designation: Model Series FM2

Features: The valves improve performance of steering booster units by providing a relatively constant volume of oil to the booster regardless of engine speed variations.

Specifications: Valves are made in 2, 4, 6, 7 and 8 gpm capacities. An integral relief valve is set to relieve at approximately 1000 psi. Two ½ in pipe tapped ports



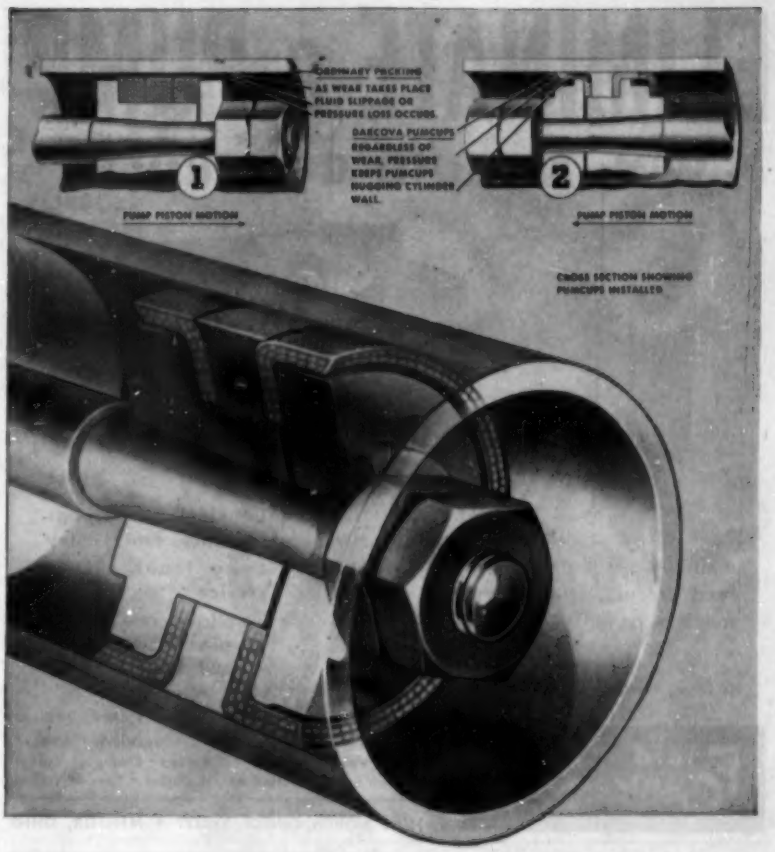
are provided in the valve body for connections to the tank and steering booster.

Vickers, Incorporated, Detroit 32, Mich.

Circle 222 on Reader Service Card

HIGH CAPACITY REGULATOR . . . is restrictor type

Design: The pressure compensated flow regulator is a 1 in non-adjustable combination bypass and restrictor type unit. Permits the use of these regulators in series to provide additional regulated circuits from one pump or power source. Over-speeding of the controlled



DARCOVA PUMCUPS mean EFFICIENCY to cost-minded engineers!

IN air and hydraulic cylinders and reciprocating pumps Darcova Pumcups actually retain full efficiency *throughout* their life span . . . and they outlast most other packings at least 3 to 1!

Special texture engineering plus the Darcova Pumcup principle makes it possible for Pumcups to hold their peak volumetric efficiency. Moreover, Pumcups permit equipment to be operated at reduced speeds, save power, prolong equipment life and eliminate the need for frequent replacement shutdowns.

For less maintenance and lower operating costs find out more about Darcova Pumcups. Write for Bulletin No. 4502 on Pumcups for air or hydraulic mechanisms, Bulletin No. 4401 on Pumcups for reciprocating pumps.

DARLING VALVE & MANUFACTURING CO.
Williamsport 15, Pa.

DARCOVA
THE ORIGINAL COMPOSITION CUP
PUMCUPS

Circle 27 on Reader Service Card

Circle 39 on Reader Service Card

ELIMINATE a PUMP

With A FLUID CONTROLS

Pick off a regulated flow from the main pump to operate an attachment, feed circuit, control system, power steering, or table lift.

- Considerable savings in space, and money
- Long trouble-free service
- Available in ¼" thru 1" pipe sizes

Write or phone Mentor, Ohio, BLackburn 5-2626 for complete specifications.

Fluid Controls, inc.

Manufacturers of Hydraulic Valves and Devices

Relief Valves • Check Valves • Restrictor Valves • Needle Valves • Pilot Check Valves • Clamping Valves • Small Spring Loaded Accumulators • Special Valves

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Air Hoist

Famous Cross ruggedness makes this the most dependable air lift for specific overhead application.

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Depend on Cross heavy-duty construction for long-life performance. Available in 3-, 4-, and 5-inch bore size, plus other standard smaller bore sizes.

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Cut installation and design in machine tool and clamp application. Choose 2-, 3-, 4-, and 5-inch bore.

Write for further details, prices, specifications, and professional advice on particular applications.

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ADDRESS_____

TOWN_____ STATE_____

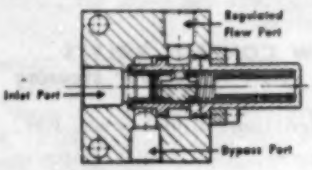
CROSS MANUFACTURING CO.
LEWIS PHONE 81 KANSAS

New Products

Continued

circuit when pressure at the bypass port is high, is prevented by the restrictive design feature. Flow from the bypass port can be used for operating other parts of the hydraulic system.

Operation: Oil passing through the orifice in the sliding valve creates a pressure differential



that pushes the valve back against the spring. Since the spring exerts a constant force, the pressure differential is constant, as is the flow which creates the differential. If this flow increases, the pressure differential also increases, and the valve uncovers the bypass port. If, after uncovering the bypass port,

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Cables: Crusade, Sowest, London.

Circle 25 on Reader Service Card

Circle 60 on Reader Service Card

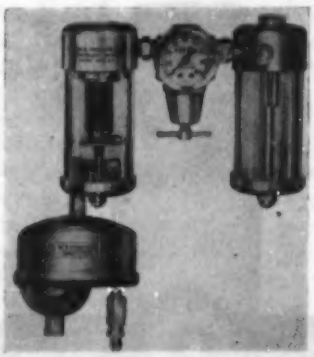
flow through the orifice tends to increase, the sliding valve moves back farther and throttles the outlet ports.

Applications: Used to maintain a constant flow when pump output varies or is greater than required for part or all of the system.

Fluid Controls, Inc.
Mentor, Ohio
Circle 223 on Reader Service Card

AUTOMATIC AIR TRAP
. . . ejects water automatically

Features: Assures dry air in pneumatic systems at all times regardless of humidity or other contributing factors. Water is automatically ejected upon accumulation of 3 to 4 oz, discharge in less than 5 sec, capacity up to 20 gph. Standpipe extends into the filter approximately 1/3 of the distance between the filter element and bottom of the bowl. The constant water leg increases the water removal efficiency of the filter without danger of water



carry-over. Heavy solids, such as pipe scale are trapped in the filter bowl where they are easily removed and cannot enter the trap to cause clogging or other damage.

Service: The sump is provided with ¼ in NPT cleanout connection which should periodically be opened and allowed to blow clear. This connection must be plugged when the trap is in service. All heavy solids which enter the trap will gravitate to the lowest point, the sump.

Applications: For all pneumatic applications; air valves, air motors, air cylinders, air tools, air vises, air presses, air hoists, air chucks and spraying equipment.

M-B Products,
Detroit 3, Mich.
Circle 224 on Reader Service Card

CYLINDERS
. . . for either air or oil

Designation: Spacemaker

Design: Unusual compactness results from elimination of tie rods. Cylinders with solid steel heads and heavy wall seamless steel body, chrome plated, insures a high safety factor.

Features: New improved cushions have been developed. Re-

ferred to as the "super cushion" for air and the new self-aligning cushion for oil. Hard chrome plated cylinder walls and piston

FOR STRICT ACCURACY

SPECIFY Goshen O-RINGS

For hydraulic or pneumatic design problems, let Goshen serve as your dependable source for O-rings. GRC O-rings are made to MIL, AMS, and commercial specifications from proven natural, synthetic, and silicone rubber compounds to meet a wide range of conditions. Laboratory and engineering facilities are at your service in solving difficult problems; your inquiries, prints, and specifications are invited.

FREE — NEW O-RING BROCHURE
Twelve pages of information on sizes, groove dimensions, application data. Designed to help in obtaining efficient sealing for most every type of application.

"FIT FOR THE JOB"

See our "facilities" catalog in Sweet's Product Design File.

BETTER FUNCTIONAL RUBBER PARTS through ENGINEERED COMPOUNDS

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Modernair

MV CONTROL VALVES

Easier to apply . . .

Compact, versatile; choice of 3 mountings and 7 manual, solenoid, cam or pilot operating means for pneumatic, hydraulic systems to 200 p.s.i.

Easier to install . . .

Sub-base, console and panel, or conventional piped mountings available. Made in ⅜", ½", ¾" and 1" NPT port sizes.

Easier to service . . .

Only moving part is one-piece spool carrying all moving seals which are standard "O" rings stocked by industrial supply houses; replaceable in minutes—no springs or retainers.

4-way double solenoid MV is only 9¼" x 3½" x 2⅝" overall (½" NPT ports); handles to 150 p.s.i.

Lever-operated MV valve body with ½" NPT ports is only 4" x 3½" x 2⅝". Handles to 200 p.s.i.

Don't lose time and money with misfits or specials when a stock MODERNAIR MV valve will do your job. Modernair valves, cylinders and parts are stocked in principal U.S. and Canadian cities, and at factory. For prompt delivery, call your authorized dealer or write us now for specifications and prices.

Modernair CORPORATION

ROOM 9A 400 PREDA ST. • SAN LEANDRO, CALIF.

New Products

Continued

rods, piston rod scrapers, chevron type self-aligning rod packings, extra wide piston of one piece construction to assure constant alignment and long packing life, and "U" cup sealing and adjusting piston packings.

Specifications: Have same mounting diameter in either an air cylinder or a low pressure hydraulic cylinder, for a maximum of 200 psi air or a maximum of 750 psi oil. Six standard styles of mounting, bores from 1 in through 4 in, and strokes from 1 in through 12 in, in even increments of 1 in; also 14 in, 16 in and 18 in, cushioned or non-cushioned.

Tomkins-Johnson Co., Jackson, Mich.

Circle 225 on Reader Service Card

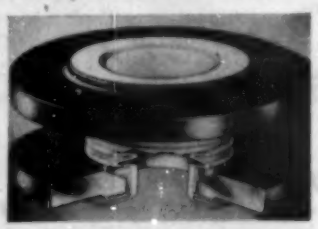
TEFLON BELLOWS

. . . have companion flanges

Size: Any pipe size from ½ through 12 in.

Design: Chemically inert, corrosion and heat resistant bellows made from Teflon, available with companion flanges conforming to American standard bolt circles and numbers for pressures up to 125 psi.

Construction: Provides efficient sealing at lower flange pressure. Gasket insert material is asbestos or synthetic rubber.



Features: A new convolution form gives greater strength, longer life and increased flexibility. Retains formation at full free length, therefore, subjected to minimum residual and working strain. Expand and contract in either direction with equal freedom of motion. Operating temperature range is from –94 F to 500 F.

Applications: Vibration dampeners, expansion joints and connectors. Available in a wide

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★GREATER FILTERING AREA
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CAPITAL HYDRAULIC OIL FILTER
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Reservoir Type for Hydraulic and Oil Re-Circulating Machinery
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5837 South Ashland Avenue Chicago 36, Illinois

range of designs suitable for metering pumps, pressure accumulators, batching scales and hydraulic systems.

Crane Packing Co., Chicago 13, Illinois

Circle 226 on Reader Service Card

LIMIT SWITCH . . . built for hard usage

Designation: 101ML1

Design: Synthetic rubber gaskets prevent moisture or foreign matter from entering the internal switching chamber. The switch features a field adjustable roller-arm actuator. The

lever is adjustable to four positions, at 90 degree intervals. This switch is electrically rated for 10 amp 110, 220 or 440 volts a-c and has a pilot duty rating of 6 amp 125 volts a-c.

Features: The heavy duty limit switch combines precision, two circuit switching with rugged construction. Use of a snap action spring accomplishes make and break of both contacts (of both the normally closed and normally open circuits). The switch's aluminum enclosure makes it useful as a control of two isolated circuits in applications where the switch is subjected to severe shock and impact.

Micro Switch Division, Minneapolis-Honeywell Regulator Company, Freeport, Illinois

Circle 227 on Reader Service Card

HYDRAULIC PISTON SEAL . . . is pressure responsive

Designation: BW Series S-11052

Size: 1 in to 4 in od

Design: Seal combines two identical Kelon piston rings with

Pack more performance into your hydraulic systems

for **PUMPS, VALVES, PRESSES, CYLINDERS...**

"John Crane" Chemlon "C-V" Rings continue to solve problem after problem in the field of hydraulic operations. Design and application is no longer hampered by the low temperature, non-corrosive limitations of conventional O and V ring packings. "John Crane" Chemlon "C-V" Rings are molded from Teflon to provide complete inertness to all hydraulic fluids, oils, and all petroleum products. They can be used through a wide temperature range from —94° to +482°F. Friction coefficient is extremely low. "Breakout" friction is only slightly higher than that of running friction.

"John Crane" Chemlon "C-V" Ring special cross sectional design affords effective sealing at practically finger-tight gland pressure.

To bring you all the important advantages of Teflon for your hydraulic sealing applications, "John Crane" has developed a complete line of Chemlon "C-V" Rings and male and female adapters. If you have special requirements, additional sizes can be molded to fit your stuffing box dimensions.

"John Crane's" illustrated booklet "The Best in Teflon" contains extensive information on a wide variety of Chemlon Products. Send for your free copy.

Crane Packing Co., 1805 Cuyler Ave., Chicago 13, Ill.

In Canada: Crane Packing Co., Ltd., 617 Parkdale Ave., N., Hamilton, Ont.

**DuPont's trademark*

JOHN CRANE CRANE PACKING COMPANY

Circle 12 on Reader Service Card

Components used in Pistons WILL LAST LONGER By using AUTO-DIESEL SCRAPER RINGS AN 6231 . 1 to 71

You can prolong the useful life of components used in pistons a long time by using Auto-Diesel Bronze Scraper Rings. They will reduce down time to the minimum and save money. They have been tested at 2,250,000 cycles and found to fit perfectly. They are made in sizes from ⅛" to 13" I.D. We make rings and circular parts for jet engines. Auto-Diesel Engineers will help you on any ring problem. Just write.

We specialize in making Quality PISTON RINGS in SMALL Runs. Give FAST SERVICE at ATTRACTIVE PRICES

Do you need PISTON RINGS in small quanities? We specialize in small runs and can give you FAST service. In addition we can sell at ATTRACTIVE PRICES. The reason is that we are set-up for this type of business—have hundreds of customers that we have served for years. Can make up to 35" diameter for original equipment and for replacement in compressors, hydraulic cylinders, valves, etc. Will make circular parts to your specifications. Write for prices.

Write for Details

THE AUTO-DIESEL PISTON RING CO.
3137 Superior Avenue • Cleveland 14, Ohio
"RINGS and SHAPES Since 1921"

Hydraulics Engineers Specify STRATOFLEX

STRATOFLEX Precision Elbow Hose Fittings are designed and engineered to fill your requirements. Whatever your specifications in detachable reusable hose fittings, and flexible hose assemblies, specify STRATOFLEX!

PRECISION ELBOW HOSE FITTINGS

- AVAILABLE IN ALUMINUM OR STEEL
- ALL SIZES • ANY ANGLE OF BEND
- FLANGE & SWIVEL NUT CONNECTIONS

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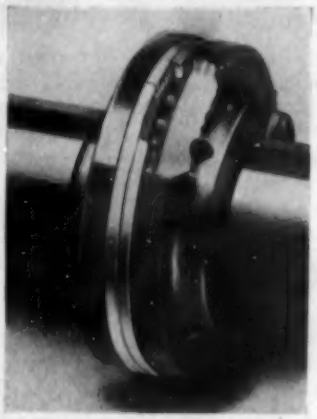
New Products

Continued

stepped, sliding joints, staggered to form a continuous seal, and a mechanical expander ring. Joint arrangement allows for dimensional changes due to heat and pressure. Stainless steel pin can be supplied which, recessed in the bottom of the piston groove, engages grooves in the seal to eliminate possibility of coincidence of the seal joints resulting from the relative rotation of the piston seals. Expander



ring provides a radial force on the rings for effective low pressure sealing.

Specifications: Operating temperatures range from –100 F to 300 F at pressures up to 5000 psi. Are tough, extremely inert and corrosion-resistant.

Application: Suitable for piston applications where very small amounts of leakage are allowable. Compact, compensates to bore irregularities and has little shift during pressure reversal. Friction at all pressures is low.

W. S. Shamban & Co.,
Culver City, Cal.
Circle 228 on Reader Service Card

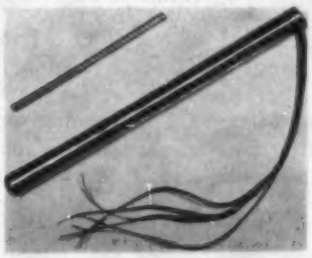
DISPLACEMENT PICK-OFF . . . has linear motion

Designation: Linearsyn Model 7S2

Design: Designed with emphasis on resistance to shock and mechanical abuse. To make the unit highly resistant to all possible electrical interference, in addition to the shielding of the

coil assembly, the moving core has been made shorter than the coil assembly.

Specification: The stroke range, in which the output is linear



with input, is 4 in (plus and minus 2 in about the null position) when the pickoff is excited with an ac voltage, the frequency of which is in the design range, 2 to 10 kc. This linear range is decreased somewhat when the excitation frequency is outside this range; e.g. at 400 cps the linear range is 3 in.

Control Components Company, Brookline Village, Mass.
Circle 229 on Reader Service Card

PILOT CONTROLLED VALVES . . . for corrosive fluids

Design: Cylinder operated, solenoid pilot controlled valves handle corrosive gases and liquids. Require a separate source of air, water, or oil for operation. Operating pressure is dependent

upon the pipe size and auxiliary pressure available. The cylinder, operated from a separate source, provides ample power to operate the valve and allows the use of stainless steel valve bodies which ordinarily could not be directly operated by a solenoid.

Features: Standard valve suitable for either normally open or normally closed operation. Available with standard watertight, or explosion proof solenoid enclosures. Can be mounted in any position. Provided with full area ports.

The Automatic Switch Company, Orange, New Jersey
Circle 230 on Reader Service Card

AIR LINE LUBRICATORS . . . are automatic

Size: ⅛ in and ½ in pipe

Design: Units have forged brass bodies and transparent plastic bowls providing a visual indication of the oil supply.

Features: Operates on very small intermittent air flows as in the case of small cylinders. Will not flood the line at shutdown, air escapes but oil is trapped, micrometer oil metering adjustment is calibrated at the factory and any required oil flow can be instantly duplicated by setting the numbered dial, will operate with air flow

SUPERIOR Announces New SAE Hydraulic Low-Carbon Steel Tubing

Practically Eliminates Tubing Failure in Critical Hydraulic Systems

Newest product to brighten the eyes of hydraulic engineers and designers is a low-carbon steel tubing that practically eliminates tube failure in hydraulic systems.

JIC specifications were a long step in this direction. Superior's SAE hydraulic tubing goes even further. 100% hydrostatic testing is at pressures which raise the fibre stress to 15,000 psi—in many sizes well above the 1,000 psi minimum required by these specifications. This contributes to greater safety at higher work and surge pressures. Also, we aim for a carbon content of .12% maximum, for ease of bending and flaring. Tube billets are made under special melting practice to insure a NON-AGING type of tubing with low yield strength and high elongation.

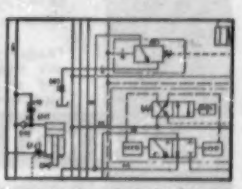
If you use hydraulic tubing—and if you want exact analysis, outstanding fabricating ease, and minutely accurate dimensions—specify Superior. Send for Catalog Section 30 and name of your nearest Superior distributor. Superior Tube Company, 2030 Germantown Ave., Norristown, Pa.

COMPARISON OF SPECIFICATIONS
Seamless Low-Carbon Steel Tubing

Detail	JIC	SAE
Check Analysis:		
Carbon	.08-.18	.05-.15
Manganese	.30-.60	.30-.60
Phosphorus	.05 max.	.040 max.
Sulphur	.055 max.	.050 max.
Physicals:		
Ultimate	55,000 psi max.	60,000 psi max.
Yield	— —	25,000/ 45,000 psi
Elong. 2" a)⅛" O.D. x .035" wall and over	40% min.	35% min.
b)Under ⅛" O.D. x .035" wall	30% min.	30% min.
Misc. Tests		
Flare	4" section expanded over mandrel having a 60° angle until inside diameter is increased 30%	
Flattening	3" section flattened to 3 x wall thickness	
Hydrostatic	Not less than 1,000 lbs. pressure	
Corrosion Protection	The corrosion preventive oil used shall be such that after extended storage periods it can readily be removed with an alkaline cleaning solution or Stoddard Solvent.	

Superior Tube
THE BIG NAME IN SMALL TUBING

All Analyses .010" to ½" O.D.
Certain Analyses in light walls up to 2½" O.D.



Partial plan of complex hydraulic system.

• Since 1928 • In the application, design and manufacture—pumps, separators, hydraulic accessories.

EQUIPMENT FOR FLUID POWER TRANSMISSION

What's your problem?

- higher pumping speeds?
- tolerance of particle-laden liquids?
- peak suction for primary pumps?

the Kraissl-50 Roller Pump

is unmatched for dependable performance on every one of those counts.

Bulletin A-1330 has full data . . . write for it. The roller-rotor design easily handles particles that would jam more tightly-fitted mechanisms—reduces cavitation, allowing higher speed operation*—develops high suction characteristics.

*Roller mechanisms permit higher speeds with any oil than most displacement designs.

KRAISSL CO

305 Williams Ave., Hackensack

in either direction without making any change.

Application: Installed in compressed air lines, they inject an oil mist into the air to lubricate air cylinders, air tools and other air operated equipment.

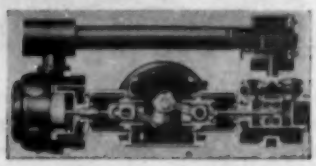
Generant Engineering Co., Newark 3, New Jersey

Circle 231 on Reader Service Card

PACKAGED AIR COMPRESSOR . . . has 75-100 hp range

Designation: PHE

Design: Opposed cylinder, balanced design driven by a direct connected, induction motor. The basic design is a two stage unit for 80-125 psi but other cylinder arrangements are available for higher pressures or for pumping vacuums. Unit requires very little floor space, a simple foundation and a minimum of piping



and connections. Full-floating aluminum bearings rotate slowly thus taking the major thrust of each succeeding stroke on a different portion of the shell. All three main bearings are interchangeable.

Features: Piston and rod assemblies of equal weight, moving in

SEND your specifications for hydraulic cylinders to American, specialists in hollow boring and honing. We manufacture from tubing or forgings in carbon or alloy steels up to 15" I.D. Over 40 years experience backed by precision machines and skilled craftsmen will save you time and money. Send your blueprints.

Telephone ERIE 2-3664

AMERICAN HOLLOW BORING COMPANY

1954 RASPBERRY STREET • ERIE, PA.

opposite directions on an 180 degree crank, balance out all primary and secondary inertia forces without the use of counterweights. Crossheads are of the aluminum piston type. Crankcase is sealed, assuring a clean interior. A direct driven lube oil pump supplies all moving parts with a generous supply of oil.

Ingersoll-Rand Company,
New York 4, New York
Circle 232 on Reader Service Card

AIR CYLINDERS
. . . for small force jobs

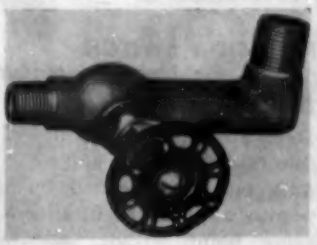
Sizes: 1-⅛ in bore and in inches and half-inches of stroke from 1 in to 6 in maximum.
Features: Cylinder is double acting and features brass heads,

nickel plated, and screwed into the honed and "copper-brited" cylinder tube. The piston rod is stainless steel and is both screwed and brazed to the brass piston. Standard "O" rings are used for sealing both the piston and the piston rod. Flange or foot mounts as well as a piston rod clevis are available.

The A. K. Allen Co.,
Brooklyn 22, New York
Circle 233 on Reader Service Card

FILTER VALVES
. . . for bottom outlet tanks

Designation: No. 807
Size: ½ in IPS x ⅜ in IPS, and ¼ in IPS x ⅜ in IPS.



Design: Equipped with oil proof packing and are thoroughly tested under pressure. Designed for use on the new bottom outlet tanks. Length of the elbow

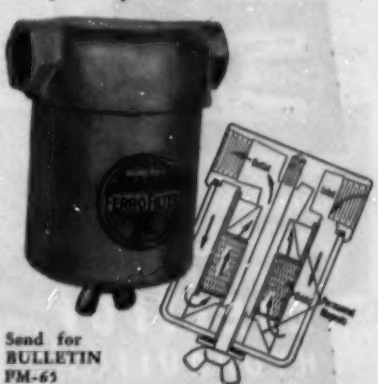
It also happens in Hydraulic Systems

Unretouched Photomicrograph (100 x) shows steel particles which passed through an edge-type strainer with .003 in. spacing. The particles were extracted by a Frantz FERROFILTER installed in the headstock lubricating oil line of a W & S No. 5 turret lathe.

FERROFILTER

Magnetic Separators

are used also to protect hydraulic cylinders, pistons, valves, pumps and other components against damage from abrasive ferrous particles worn off moving parts. Install Frantz FERROFILTERS on your fluid power lines to reduce maintenance and parts replacement.



Send for BULLETIN FM-65

S. G. FRANTZ CO., Inc.
P. O. Box 1138 Trenton 8, N. J.

"POWER-FLARE"

Flaring by roll process and established speed, the "Power-Flare" machine has greatly improved the flare of all types of tubing used in hydraulic systems.

It gives a smooth, always uniform, surface for seating; the metal is not work hardened near the danger point; and by creating a burnished surface, tool marks, scratches and burrs are eliminated.

Immediate delivery.

One size machine flares steel, copper, aluminum and stainless steel from ⅜" OD. to 2" OD. Dies for 30, 37 and 45 degree angle fittings are available.

Numerous users have expressed complete satisfaction. "Power-Flare" has been proven in the field for over five years.

COX **Engineering and Sales Company**
3022 E. Canfield, Detroit 7, Mich., Phone WAlnut 1-3094

Continued

is sufficiently long to assure plenty of clearance between the tank and the valve handle when being installed. Handle is easily accessible from the side although the valve is installed on the bottom.

Rockford Brass Works,
Rockford, Illinois
Circle 234 on Reader Service Card

PRECISION SWITCH
. . . for high temperatures

Designation: IHTI

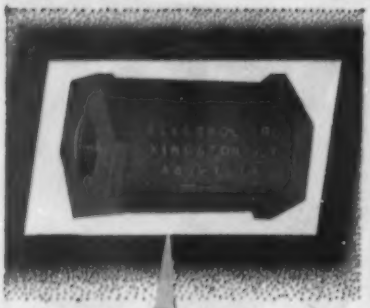
Design: Panel mounting. Two thin hexagonal nuts and two lock nuts on the threaded bushing permit adjustment of the operating point without removing the switch from its mounting.

Specifications: Operating force 10 to 20 oz.; pretravel .065 in max.; differential travel .010 in max.; overtravel .125 in max.

Applications: Because of its small size is ideal for high temperature aircraft applications. Its capacity for switching a substantial electrical load in a tem-

perature range of –50 F to 1000 F makes it equally well suited for high temperature industrial applications, such as vulcanizing plants and other industries which require high temperature components.

Micro Switch,
Division of Minneapolis-Honeywell Regulator Co.,
Freeport, Illinois
Circle 235 on Reader Service Card



Electrol Check Valves

Prevent Reversal of Flow in AIR . . . OIL OR WATER APPLICATIONS

Electrol (463FP) Check Valves are ideally suited for heavy-duty service applications—providing positive sealing against return flow in air . . . oil . . . or water control lines, with a minimum of pressure drop. They have a maximum operating pressure of 5,000 P. S. I., with a cracking pressure — in free flow direction —from 2 to 8 P. S. I. Elements are of brass and bronze — and include an O-ring check seat. Sizes range from ⅛" to 2" N.P.T. Your inquiries will receive prompt attention.

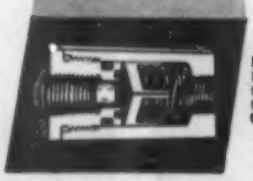
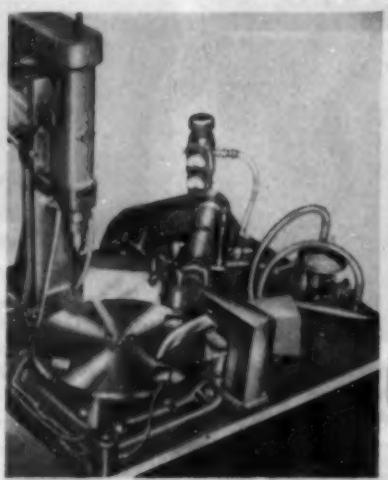


Diagram showing internal construction of the Electrol (463FP) Check Valve.

Better Designed Products Use Electrol Hydraulics

Electrol HYDRAULICS
KINGSTON, NEW YORK
Telephone Kingston 1980

CYLINDERS • SELECTOR VALVES • FOLLOW-UP VALVES
CHECK VALVES • RELIEF VALVES • HAND PUMPS
POWERPAKS • LANDING GEAR OLEOS • SOLENOID
VALVES • ON-OFF VALVES • SERVO CYLINDERS • TRANSFER
VALVES • CUT-OUT VALVES • SPEED CONTROL VALVES



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DIAL FEED TABLES
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ALSO AVAILABLE:
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CYLINDERS

• AIR • WATER
• L.P. HYDRAULIC

NOW! NATIONAL O-RINGS

- **Complete commercial grade line**
- **Consistent quality, uniformity**
- **For dynamic or static applications**
- **New, easy-to-use catalog**

You know National's reputation as a leading manufacturer of oil seals and shims. Now, you can have the same dependable quality, the same complete service on O-Rings.

National O-Rings are molded to precise tolerances. They are available for dynamic or static applications in all standard sizes, commercial grade, covering a wide range of pressures and temperatures. Get complete information today.

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May permit simpler, lower cost design
Effective in limited space, easy to install
Seal both directions of pressure flow
Withstand wide temperature range
Permit metal-to-metal joints
Hold running friction to minimum
May eliminate adjustment devices
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NATIONAL MOTOR BEARING CO., INC.
General Offices: Redwood City, California
Plants: Redwood City and Downey (Los Angeles County) Calif.; Van Wert, Ohio

2857

NEW! NATIONAL O-RING CATALOG SENT FREE

Broadly useful compilation of O-Ring data sent free to engineers on written request. Includes engineering, design and compound information, gland-groove and back-up ring requirements, etc. Lists all standard size National O-Rings. Write for your copy today!

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O-RINGS SHIMS

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CLEVELAND, OHIO . *210 Heights Rockefeller Bldg., YEllowstone 2-2720*
DALLAS, TEXAS . . . *3014 Highland Park Village, JUstin 8-8453*
DETROIT, MICH. . . . . *726 Lothrop Avenue, TRinity 1-6363*
DOWNEY (Los Angeles Co.), CALIF. . *11634 Patten Rd., TOpaz 2-5166*
MILWAUKEE, WIS. . . *647 West Virginia Street, BRoadway 1-3234*
NEWARK, N. J. . *Suite 814, 1180 Raymond Blvd., MItchell 2-7586*
REDWOOD CITY, CALIF. . . *Broadway and National, EMerson 6-3861*
WICHITA, KANSAS . . . . *519 South Broadway, WIchita 2-6971*

USEFUL LITERATURE

You'll find many valuable production and design ideas in publications described here . . . copies will be sent you free without obligation

Continued from page 12

PNEUMATIC TRANSMITTER . . . provides a fast linear response in output air pressures for every position of the rotameter metering float. The basic principle involves a force-balance pneumatic system which requires an absolute minimum of mechanical motion, resulting in low inertia characteristics and improved response time. The two pistons are made of highly finished stainless steel. They move within cylinders made of precision bore glass. A small amount of air is bled out around the pistons creating an air cushion to reduce friction to a minimum. The armature, the only moving part, is supported by a cross flexure arrangement. Bulletin 170, available from Brooks Rotameter Co. also includes dimensions and capacities for the various sizes.

Circle 157 on Reader Service Card

STAINLESS PIPE AND TUBES . . . made in a variety of analyses to meet the requirements of modern industrial applications are described in a 24 page bulletin No. 3. released by National Tube Division, United States Steel Co. The steels have resistance to oxidation and corrosive attack. Complete tables show the nominal properties of various steels. Corrosion resistance data is given showing resistance of the steels to a number of reagents. Additional information such as dimensional tolerances, weights and surface dimensions are included.

Circle 158 on Reader Service Card

AIR DRIVEN LIQUID PUMP . . . Capable of developing pressures to 30,000 psi is described in a 4 page bulletin covering data on the Model S-216-C. The bulletin is available from Sprague Engineering and Sales Corp. The pump may be incorporated directly into the design of all types of hydraulic machines, for clamping, pressing, riveting, crimping, shearing or punching. It may be used to replace electrically driven hydraulic pumps where the flow requirement is low. It pumps only the amount of liquid needed by the system. No constant by-pass is required when the system has reached full pressure. Operating characteristics, specifications and capacity data is included. Cutaway view shows the construction.

Circle 159 on Reader Service Card

ELECTRIC RELAYS . . . Six relays are presented in a 4 page folder made available from Sigma Instruments, Inc. Duplicate information is given for each of the types; this includes rating, sensitivity, maximum coil resistance, coil dissipation, speed range; mountings, enclosures and designations; and features. The relay series covered in the bulletin include, dc relays; ac and dc relays; dc relays midget; dc relays-polar and dc relays-polar, telegraph keying.

Circle 160 on Reader Service Card

LINEAR ACCELEROMETERS . . . suitable for static and dynamic measurements are described in bulletin AL-1 available from Statham Laboratories, Inc. The resistive nature of the balanced four arm bridge permits operation in either dc or ac circuits, so that a wide range of recording, telemetering and controlling systems may be employed. An unlimited variety of ranges and resistances are possible. General specifications and the characteristics of the various models are included.

Circle 161 on Reader Service Card

"OILGEARDUCERS" . . . combine fluid power, constant displacement, axial piston motors and Falk all-steel reducers into integral "any speed" output units. When used in combination with variable delivery pumps, Oilgearducers provide accurate speed regulation over entire range, an infinite speed range, quick reversal, constant torque, hydrodynamic braking. Bulletin 56610, released by The Oilgear Company completely describes these features. These units have resilient coupling connected shafts and can be furnished for mounting in any position to drive the machinery through a coupling, pulley, sheave, sprocket or gear. Installation drawings are included.

Circle 162 on Reader Service Card

HYDRAULIC AND PNEUMATIC CONTROLS . . . are presented in catalog 4G available from Barksdale Valves. Manual valves, solenoid valves, solenoid pilot controlled valves and pressure switches are included in the booklet. Many models of the above types are also illustrated. The 36 page catalog is in color. The valving principle is explained. Each of the valves presented are illustrated by cross-section views and flow patterns. Valve characteristics are shown together with port size, minimum flow passage, rated flow at 20 fps velocity. The solenoid valve data includes port size and electrical ratings. A pressure switch selection chart guides step by step the selection of the proper switch. Operating characteristics are shown for the pressure switches.

Circle 163 on Reader Service Card

Circle 78 on Reader Service Card

MARSH MAKES IT!

If it's a pressure gauge or dial thermometer, Marsh makes it . . . and makes it better. The types, ranges and case styles are endless. What is "special" to other instrument makers is often standard to Marsh. To know the scope of Marsh instruments—

Write for this fact-filled catalog

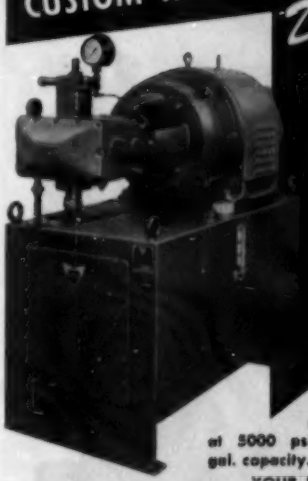
MARSH INSTRUMENT CO.,
Sales affiliate of Jas. P. Marsh Corporation,
Dept. 19, Skokie, Ill. *Export Dept.*, 3501 Howard St., Skokie, Ill.

Circle 20 on Reader Service Card

MORE POWER TO YOU . . . from CENTURY!

CUSTOM HYDRAULIC POWER UNITS

Designed **RIGHT!**
Built **RIGHT!**
Priced **RIGHT!**



For example— This Century designed and built Power Unit, 50 H. P. motor drives variable delivery pump with maximum output of 20 gpm at 3000 psi. Century reservoir is 125 gal. capacity.

YOUR INQUIRIES ARE INVITED

CENTURY HYDRAULICS, INC.
8868 GREENFIELD — DETROIT 28, MICHIGAN

REPUBLIC "LO-TORQ" SELECTOR VALVE

0-6000 psi SERVICE with LOW TURNING TORQUE

Exceptionally low turning torque is obtained by "floating" the valving disk in the service fluid, thereby balancing the pressure and eliminating thrust bearings . . . a sound application of the hydraulic engineering principle that fluids under pressure exert force equally in all directions.

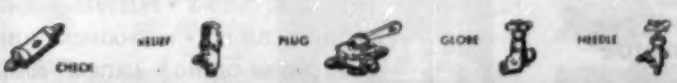
Sealing rings on both sides of the selector disk eliminate leakage at all times whether pressure is forward, back, or off entirely.

For air and gas service, 0-1000 and 0-3000 psi; for fuel, hydraulic oil, petroleum, and water service, sizes ⅛" to 1", 0-2000 and 0-6000 psi. 2, 3, and 4-way.

Write for catalog no. 454 for complete information.

Distributors in principal cities from coast to coast.

- 0-6000 psi service
- Low turning torque
- Panel mounting
- Semi-steel, bronze, aluminum alloy
- No leakage at any time
- 3 types of portings



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REPUBLIC MANUFACTURING CO.
16455 BROOKPARK ROAD • CLEVELAND 11, OHIO

Unlimited Mounting Possibilities

... with these pumps for pressures up to 500 psi

When mounting pumps, foot position may be varied in relation to ports at 90° stages through a complete circle.

You can meet practically any mounting requirement with pumps in the Brown & Sharpe 500 Series. Compact flanged stand and separate foot-type bracket make installation easy in any position . . . allow quick adaptation for duplex and motor-drive units. Suction and discharge ports on both sides and ends of pumps facilitate piping. In addition, you get such top-performance features as quiet-running hardened gears, long-lived needle bearings and mechanical sealing . . . for positive, trouble-free service. Write for New 70-page Pump Catalog 35P. Brown & Sharpe Mfg. Co., Providence 1, R. I., U.S.A.

BUY THROUGH YOUR LOCAL DISTRIBUTOR

Brown & Sharpe

USEFUL LITERATURE

ELECTRIC POWER DRIVES . . . are presented in a new 8 page application tabloid bulletin, released by Sterling Electric Motors, Inc. Brochure presents 60 photographs on power drives for machinery and many other kinds of equipment. Pages have been divided by industries, and include application stories from food, metal, chemical, petroleum, plastic, paper, printing, lumber and textile industries.

Circle 164 on Reader Service Card

CONTROL VALVES . . . for pneumatic or hydraulic application are described in a 52 page catalog, released by Marotta Valve Corp. Included in the catalog are valves for aircraft, guided missiles, automotive and industrial uses. Book is divided into sections on magnetic, check, regulating and special valves. Complete line is included, with large detailed illustrations of each valve, applications, specifications, installation drawings and flow curves.

Circle 165 on Reader Service Card

PLUNGER PUMPS . . . A new bulletin W-414-B45 on vertical triplex, single action plunger pumps is now available from Worthington Corp. Graphically illustrated by photos, charts, and line drawings, the bulletin contains information about features, applica-

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Summerill Tubing Division

Columbia Steel & Shafting Co.

PITTSBURGH 30, PA.

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Manufacturers of

Cold Drawn Seamless Steel Tubing

HYDRAULIC TUBING • PRESSURE TUBING
CONDENSER TUBING • MECHANICAL TUBING
DIESEL ENGINE TUBING • AIRCRAFT TUBING
SPECIAL SHAPES

Circle 18 on Reader Service Card

Circle 114 on Reader Service Card

tions, ratings, dimensions and specifications. Interchangeable plunger sizes, individual valve covers and flanged suction and discharge openings, stuffing box drains and automatic oiling system are some of the features discussed.

Circle 166 on Reader Service Card

POWER TRANSMISSION CHAINS . . . for high speed and heavy duty service, employing radically new principles of joint articulation and tooth engagement, accomplishes the elimination of chordal action. During the period of load transfer between chain and sprocket, there is no appreciable change in the effective pitch radius. This results in constant speed relationship between chain and sprocket. Constant rotative speed is transferred into constant linear speed—as a pinion driving a rack. Specifications and capacity curves are included for standard ¾, 1, 1-¼, 1-½, and 2 in pitch chain from 2 to 12 in wide. Write to Morse Chain Company for catalog C 72-51.

Circle 167 on Reader Service Card

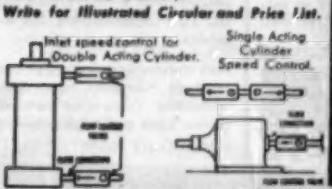
LATTICE BRAID PACKING . . . for rods and shafts, are described in an 8 page folder issued by The Garlock Packing Company. Just how this packing is made, is shown with illustrations. In these packings the "through and through" braiding makes each strand flexible, so there is no stress when rings are formed. By lubricating each strand the lubricant is evenly distributed throughout the packing. Each strand passes

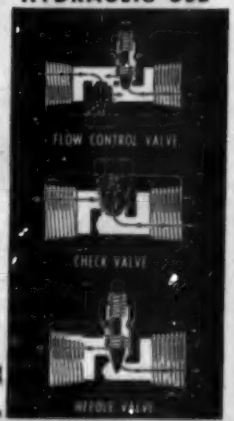
Get Easier, More Accurate Cylinder Speed Control with Pneu-Trol VALVES IN AIR OR HYDRAULIC USE

2000 and 3000 (steel) P.S.I.

Pneu-Trol Valves combine in a short, compact body, a tapered fine thread needle for extremely accurate air or oil flow control and a floating retro ball check, which permits full flow in the opposite direction. Retro ball floats in most sensitive position to seat, requiring only a slight differential pressure to fully open or close it. Check Valve and Needle Valve incorporate single function features of Flow Control Valve. All valves available in 5 female pipe sizes—⅛" to ¾". Valve bodies are made from brass, aluminum, steel or stainless steel. Attractive Prices—Immediate Delivery.

Write for Illustrated Circular and Price List.





Pneu-Trol Devices, Inc.
1426 N. Keating Ave., Chicago 51, Ill.

Circle 96 on Reader Service Card

Now in its 6th year

NOPAK Shelf-Stock Service . . .

based on these 2 Standard Mounting, Class 1, Cushioned Cylinders

LIST PRICES F.O.B. Milwaukee, Wisconsin — Subject to Revision.

Cyl. Dia. Bore	STOCK STROKE LENGTHS — All Double Acting								
	1"	2"	3"	4"	6"	8"	10"	12"	15"
1½"	24.16	25.72	26.08	26.44	27.16	27.88	28.60	29.32	30.40
2"	27.24	27.88	28.32	28.76	29.64	30.52	31.40	32.28	33.60
2½"	32.36	34.12	34.68	35.24	36.36	37.48	38.60	39.72	41.40
3"	35.04	37.28	37.92	38.56	39.84	41.12	42.40	43.68	45.60
4"	40.84	43.68	44.52	45.36	47.04	48.72	50.40	52.08	54.60
4½"	48.96	51.92	52.88	53.84	55.76	57.68	59.60	61.52	64.40
6"	66.60	70.80	72.20	73.60	76.40	79.20	82.00	84.80	89.00
8"	———	126.80	129.20	131.60	136.40	141.20	146.00	150.86	158.00

By specifying NOPAK Shelf-stock, you buy *quality cylinders* at lowest prevailing prices, you *eliminate waiting* for "specials", reduce engineering costs. Compare the prices and scope of NOPAK Shelf-stock (1½ x 1" to 8 x 15") with competitive offerings — and you *will specify* NOPAK.

● Basic mountings "A" or "E" convertible to "B", "C", "D" or "F", (see below) by changing cylinder heads. Add 10% to above prices (no extra charge 8" bore). ● Piston Rods NF male thread. ● Cushioning can be eliminated on rod, blank or both ends by removing spring and ball-check.

NOPAK 4-Way Valves, hand, foot, solenoid, or pilot operated, to actuate all cylinders, *also in Shelf-stock.*

GALLAND-HENNING NOPAK
2743 SOUTH 31st STREET
MILWAUKEE 46, WIS.

NOPAK
VALVES AND CYLINDERS
DESIGNED for AIR and HYDRAULIC SERVICE

TEAR OUT THIS AD for Reference, — or write for extra copies.

A 8005-½-R

Circle 43 on Reader Service Card

diagonally through the body of the packing at an angle of approximately 45 degrees. There is no single outer braid or outer cover to wear through. Features and general recommendations for various types of service are included. Available in sizes from ¼ in to 1 in.

Circle 168 on Reader Service Card

"SWITCHES FOR INDUSTRY" . . . is the title of a newly published catalog, available from Micro Switch, a division of Minneapolis-Honeywell Regulator Co. Catalog 101 consists of 20 pages, in color and covers 22 different types of switches, describing 258 different switches, actuators and enclosures. Photos are used to show outside dimensions. Characteristics, electrical ratings and technical data are so arranged as to aid the designer in the selection of the correct switch for his application. The products described range from postage stamp size "V-3" to heavy duty "ML" limit switches.

Circle 169 on Reader Service Card

PROTECTIVE CLOSURES . . . for use on hydraulic lines and assemblies when handling, shipping and storing is described in a new plastic bound 14 page catalog containing specifications and prices. The catalog may be obtained from Tubing Seal Cap, Inc.

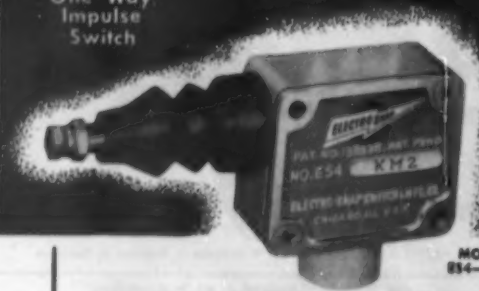
Circle 170 on Reader Service Card

ELECTRO SNAP

Exclusive—

SIMPLIFIED CONTROLS

One-Way Impulse Switch



MODEL 854—KM3

ELIMINATES INTERLOCKING SWITCHES AND COMPLICATED ACTUATING DOGS
This exclusive switch is ideal for pulsing solenoid valves on air-hydraulic controls, sequencing circuits, etc., because it allows other controls to reverse or operate the same circuit. It sends a short electrical impulse and then switches itself out of the circuit.

GIVES MORE DEPENDABLE CONTROL
Switch replaces timers, relays, and troublesome one-way dogs to simplify circuits—cuts chances for failure. No delicate adjustments.

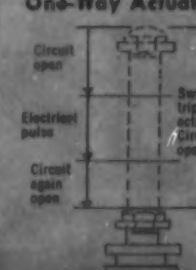
LOWERS COST OF CONTROL CIRCUITS
Impulse switch costs less than complicated control devices it replaces. Fewer switches are required for sequencing. Because of simplicity, maintenance is easy.

SPEEDS UP AUTOMATIC OPERATION
Automatic machines can run faster because cycles can be more closely sequenced. There's no delay due to timer tolerances or extra machine motions to actuate interlock switches.

TRY IT NOW—WRITE FOR BULLETIN ESF-9

SPECIFICATIONS
rated at 10 amps., 125/250 v. AC.
Movement differential 0.022".
Operating Force 1½ lbs.
Four models available with overtravel and pulsing strokes from 1/16" to 3/8".

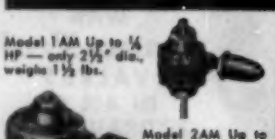
How Exclusive One-Way Actuator Works



ELECTRO-SNAP SWITCH & MFG. COMPANY
4224 West Lake Street, Chicago 24, Illinois

how 10 characteristics of

GAST rotary AIR MOTORS


Model 1AM Up to ¼ HP — only 2½" dia., weighs 1½ lbs.
Model 2AM Up to ½ HP — weighs approx. 5¼ lbs.
Model 4AM Up to 1 HP — only 5⅜" high (less muffler).
Model 8AM Up to 4 HP — only 6½" high (less muffler).

WRITE GAST for Air Motor Bulletins. Request "Ideas" Booklet.

see our catalog in Sweet's PRODUCT DESIGN FILE or write for copy

solve tough original equipment problems

Just one of these ten inherent advantages of Gast rotary Compressed Air Motors may solve knotty problems on your original equipment applications.

1—Low first cost. 2—Explosion-proof safety. 3—Variable speed. 4—Can't burn out from overloads or stalling. 5—Four vanes — instant starting. 6—Amazing compactness for HP. 7—Light weight —to ¼ of electric motor. 8—Smooth rotary-vane ball-bearing performance. 9—Reversible models. 10—Dependability for long service.

Now standard equipment on many products. Four sizes, many design variations. Vertical or horizontal drives; base or flange mountings.

INVESTIGATE NOW!

Original Equipment Manufacturers for Over 25 Years

GAST ROTARY AIR MOTORS · COMPRESSORS · VACUUM PUMPS
(TO 4 H.P.) (TO 30 LBS.) (TO 28 INCHES)
GAST MANUFACTURING CORP., 181 Mulberry St., Benton Harbor, Mich.

Circle 35 on Reader Service Card

Circle 44 on Reader Service Card

GEAR TYPE PUMPS . . . which are oil hydraulic and pressure balanced for heavy duty machine tools are described in Bulletin No. 142 issued by Hydreco Division, The New York Air Brake Co. The series H pumps are designed for heavy duty machine tools, materials handling and earth moving equipment. The four sizes available deliver 40-50-60-70 gpm at 1200 rpm and operate at pressures up to 1500 psi. A chart gives performance details on all four pumps, cutaway drawings show construction details.

Circle 171 on Reader Service Card

AIR CONTROL VALVES . . . manufactured by Ross Operating Valve Co. are presented in 12-page bulletin 101B. Pilot operated valves, remote control valves and direct operated valves are all described. Cutaway views in color show air flow, construction and operation of the valves. Features of the units are explained and the available syles, models and sizes are outlined.

Circle 172 on Reader Service Card

PLUG VALVE ACTUATORS . . . pneumatically and hydraulically operated for remote controls and automatic processing, are the subject of an 8 page bulletin 3020, released by Ledeen Mfg. Co. Designed for installations either on new valves or on existing valves already in service. Air, oil or water actuators are available. Direct or remote control by hand or pilot operated valves. Suitable for most control requirements including instrument controls. Applications, mountings and dimensions are also included.

Circle 173 on Reader Service Card

hydro-line cylinders series "J"

conform to
J. I. C. standards

RUGGED . . .

Where it counts most!

CARTRIDGE . . . metallic rod-wiper, packing, bushing in one unit.

RUGGED BODY . . . all steel end caps and barrel.

PISTON RINGS . . . step-cut joint, long life, minimum leakage.

PRESSURE . . . 2,000 psi heavy-duty . . . 3,000 psi non-shock.

SIMPLICITY . . . no tie-rods . . . no retainer rings.

hydro-line *Manufacturing Co.*

5568 PIKE ROAD • ROCKFORD, ILLINOIS

Circle 61 on Reader Service Card

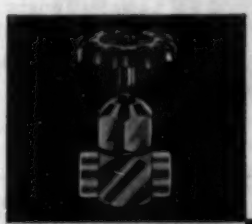
L and L

STEEL HYDRAULIC COUPLINGS

"THE MOST COMPLETE FITTING LINE"

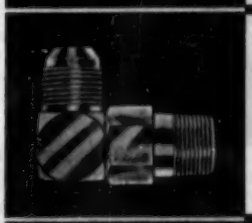
JIC FLARED TUBE
DRYSEAL PIPE FITTINGS
RESTRICTORS
LATERALS
BARBED HOSE STEMS
HYDRAULIC ACCESSORIES

new products :

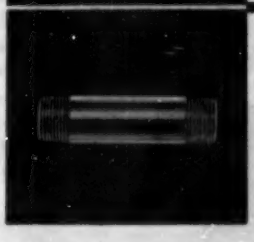


NEEDLE VALVES
- 5000 PSI
- Compact, bar stock body
- Use for shut-off or metering
- Tube or pipe outlets
- Line or angle

BALL CHECK VALVES
- Compact, bar stock body
- Tube or pipe outlets
- Fixed or adjustable spring loading



SWIVEL ELBOWS
- 1200 PSI
- Tube or pipe outlets
- Rotates 360°



PIPE NIPPLES
- Clean bore, seamless steel tubing
- Dryseal NPTF threads
- Cadmium plated

Representatives in principal cities
WRITE FOR CATALOG #53

L and L MANUFACTURING CO.
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Circle 68 on Reader Service Card

Post Scripts of Industry

News about people, manufacturers and sales organizations

Archie F. Wilson
The Hydraulic Press Mfg. Co.

The Hydraulic Press Mfg. Company has announced the appointment of **Archie F. Wilson** as director of manufacturing. Prior to coming to the company, he was manager of plant operations at Mather Stock Car Company of Chicago, which manufactures and leases freight cars. In this position he supervised operations of the firm's eight plants throughout the nation.

Robert H. Clare
Standard Pressed Steel Co.

Robert H. Clare, former head of the Scientific Gage Company in Detroit, has been assigned by **Standard Pressed Steel Co.,** Jenkintown, Pa., to the company's 11 state, west coast sales territory. The sales territory in which Clare will work, includes California, Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming, the city of El Paso in Texas and British Columbia.

Edgar L. Disbrow
Heat-X-Changer Co.

Bush Manufacturing Co., and its wholly owned subsidiary, **Heat-X-Changer Co.,** Brewster, N.Y. have announced the appointment of **Edgar L. Disbrow** as a sales engineer in their midwest district. Working out of the company's Chicago office, he will cover Minnesota, Iowa, North Dakota, South Dakota, Nebraska and northwestern Wisconsin.

Robert W. Peterman has been appointed sales manager of the **Nopak Division** of the **Galland-Henning Mfg. Co.** In his new capacity, he will handle all matters relating to general sales supervision and sales engineering. **Robert J. Garnik** has been appointed chief engineer responsible for new product design and development. In addition, he will be responsible for adapting products to special applications involving engineering changes which cannot be handled in the field.

Sol Baker has been appointed to the position of project engineer at the Ravenna, Ohio plant of **Allen Aircraft Products, Inc.** He has spent over ten years at NACA's Lewis Flight Propulsion Laboratory as a project engineer and plant engineer. Just prior to joining the company he was project engineer with Spo, Inc.

The new **Eaton Screw Products Co.** plant in Eaton, Ohio, recently built and dedicated by **The Parker Appliance Company** is now in full operation. The plant, which turns out tube and hose fittings for hydraulic and other fluid systems, provides 23,000 sq ft of manufacturing space, compared with the 7,000 available in the old Eaton plant.

Robert O. Isenbarger was named chief engineer in charge of all **Chicago Rawhide Manufacturing Company** field engineering. He will be assistant to vice president Phelps Wilder. **Alfred S. Berens** was appointed director of engineering and a member of the company's management council. **Arnold P. Barth** was named chief chemist in charge of the laboratory at the Elgin plant. All three men have been associated for many years with Chicago Rawhide Manufacturing Company.

Circle 59 on Reader Service Card

PROTECT YOUR HYDRAULIC SEALS with the IMPROVED Seal-Guard®

Here is a BETTER WAY to insure long life for cylinder rod packings, bearings, machine spindles, guide pins.

Seal-Guard's flexible bronze, knife-edge wiping rings mould themselves to the shaft contour . . . peel off dirt and grime . . . lift it entirely away from the shaft—no packing or crowding under.

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• Available in a wide variety of general purpose and special purpose gauges in pressure ranges to meet your specifications in every particular.

WRITE TODAY FOR COMPLETE INFORMATION

PRESSURE, VACUUM, COMPOUND, ALTITUDE, COMBINATION, DIAPHRAGM, HYDRAULIC, AND SPECIAL PURPOSE GAUGES, DIAL THERMOMETERS, (VAPOR TENSION OR BI-METAL)

MARSHALLTOWN MFG. CO.
800 East Nevada St., Marshalltown 4, Iowa

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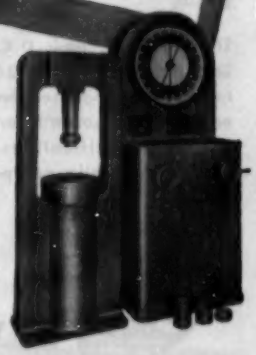
PALMETTO® G-T® RING

MEANS SIMPLIFIED DESIGN
MEANS LESS MACHINING TIME

ASK BALDWIN!



The Baldwin-Lima-Hamilton Corporation, Eddystone, Pa. Division, recognized a manufacturing advantage in the PALMETTO G-T Ring. Designing it into their Baldwin Compression Testing Machine (capacity—50,000 lb; pressure—1,000 psi; stroke—5 in.) meant design simplification—a simple groove instead of a complex stuffing box. Here is where engineering foresight paid off . . . Changing to this modern dynamic ram seal not only saved space, but hours of machining as well. Because high sealing efficiency and long service life are maintained along with these manufacturing advantages, the PALMETTO G-T Ring is now standard for Baldwin in this application.

CANNOT SPIRAL . . .

The Palmetto G-T Ring, unlike an O-Ring, will not twist and turn in the groove. T-form prevents spiral failure even in dynamic applications.

CANNOT EXTRUDE . . .

Resilient "T"-section supported by non-extrusion rings on either side makes extrusion impossible. As pressure is applied, non-extrusion rings are urged against cylinder wall, blocking the path of extrusion.

Write for our Manual MP-200, Engineering Standards for Palmetto Molded Packings. For design information on G-T Rings, see our catalog in Sweet's Product Design File.

PALMETTO Packings

packing more performance into every application

GREENE, TWEED & CO. North Wales, Pa.

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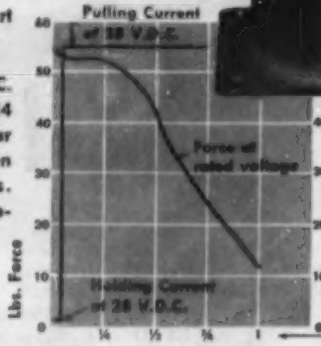
Circle 29 on Reader Service Card

Decco DUAL WOUND D. C. SOLENOIDS

Compact Efficient Powerful

Because of its "Dual wound" construction the new Decco Series 29 D. C. Solenoid is able to deliver tremendous force in small space in continuous service. See Force Stroke Chart below.

This compact, new D.C. Solenoid is available in 24 to 250 Volt range, regular or waterproof construction —J.I.C. Specifications. Ideal for mobile equipment.



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Decco

DETROIT COIL COMPANY

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Post Scripts of Industry

Donald A. Anderson

The Rucker Co.

Donald A. Anderson was appointed as San Francisco sales representative for **The Rucker Company.** Anderson joined the firm a year ago, and, before being named to his new position, had received extensive sales training in all company operations.

Flexonics Corporation has announced two advancements in its Maywood, Illinois headquarters

And Now-A Gresen

MULTI-CONTROL VALVE

Capacity 24 GPM
Max. Pressure 1250 PSI
Parallel Application

Model V P

Another Gresen Engineering Triumph In Quality Hydraulics

For Mobile and General Industrial Applications.

FEATURES - - -

- Fully Balanced—Self Centering—Built-in Adjustable Relief Valve.
- Relief Valve Has Replaceable Hardened Seat
- Tripod Mounting Foot
- Check Valve Effective On All Spools
- Smooth Positive Easy Control
- Hardened and Chrome Plated Spools
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Center sections are available making additional Controls in this Multi-unit.

Write for full details about this better built, money saving valve.

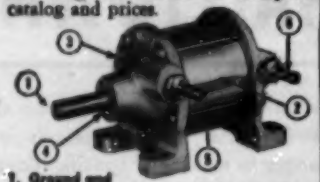
GRESEN MANUFACTURING COMPANY

4328 Cedar Ave. N. Dept. H-24 Minneapolis 11, Minn.

AIR-MITE AIR CYLINDERS

Low Cost Compact Powerful Rugged

AIR-MITE Cylinders—made in single or double acting series—in 4 mounting types, are high quality cylinders at a low price. Simple, rugged design and compact construction give them long life, permit easy mounting on jigs, fixtures, tools, or machines. Used wherever power holding, pushing, pulling or lifting is required, AIR-MITE cylinders will meet your most exacting standards of dependability and long life. Write for complete catalog and prices.



1. Ground and polished steel rams
2. Brass, true-bore cylinders
3. High strength aluminum alloy cylinder heads
4. Bronze oilless ram bearing
5. Five steel tie rods
6. Brass base stems

4 Mounting Types

AIR-MITE Devices, Inc.

4415 W. CARROLL AVENUE • CHICAGO 24, ILLINOIS

Circle 52 on Reader Service Card

Circle 3 on Reader Service Card

sales organization. **Harvey Wilson,** office sales supervisor of the expansion joints division becomes a field sales engineer. **Walter Keipper** of the office sales staff is being promoted to the position formerly held by Wilson.

Edwin L. Shaw (right)
Roland N. Crossley (left)
Aircraft Products Div.
The Denison Engineering Co.

A new division of **The Denison Engineering Company** to be known as the **Aircraft Products Division** has recently been established. The division will sell, service and manufacture items for sale to the aircraft industry, both military and commercial. **Edwin L. Shaw,** a veteran of aircraft component development with the company has been appointed head of the division. **Roland N. Crossley** is director of sales and **James Parr** is chief engineer of the division. Also announced by the Denison Engineering Company was the appointment of **Robert A. Monague** as field engineer for the Tulsa office. Monague joined the company recently and has just completed a factory training program at the home office.

Robert A. Monague
The Denison Engineering Co.

Simplex Engineering Company in Zanesville, Ohio has announced the appointment of **L. E. Bartling,** Room 2250, 608 South Dearborn, Chicago 5, Illinois, as their representative for Chicago and the surrounding area.

Avels Sales & Engineering Co., Indianapolis, Ind., has been named an authorized distributor of Hoze-Lok fittings and hose assemblies, by **The Parker Appliance Company.** The firm will maintain stocks of fittings for the needs of customers throughout the central Indiana area. Recently, this firm moved into new and larger quarters at 1728 West 16th St., Indianapolis.

Promotion of **Dave N. Allensworth,** formerly sales engineer in Seattle, Wash., to manager of the Indiana district was announced by **The Parker Appliance Company.** Allensworth will direct sales of tube fittings, hose fittings, hydraulic valves and related products in the Indiana district.

"FULFLO" VALVES

By-pass, oil-relief piston type hydraulic

Standard and Flange models

NO TRICK AT ALL . . .

Just select from 5 springs, install and your FULFLO VALVE is ready to go to work . . . TO MAINTAIN CONSTANT, UNIFORM PRESSURE . . . from 0 to 500 lbs.

NON-CHATTERING, TOO . . . because the cylindrical piston closes off the port in a shearing manner.

FOR . . . machine tool hydraulic mechanism, oil-burning equipment, rams, presses and Diesel engines.

Pipe sizes: ¼" to 2"

WRITE—on your letterhead, please, for personal copy of FULFLO MECHANICAL DATA BOOK

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PUMP AND VALVE MANUFACTURERS
BLANCHESTER, OHIO

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machine
performance
with
LOVEJOY
Variable Speed
PULLEYS

Quickly, easily installed on old or new machines . . . allowing infinitely variable speed adjustments over wide range. A mere turn of hand instantly, accurately speeds up or slows down the driven unit for **changes in production schedules . . . adjustment for operator ability . . . corrections for size or density of stock, temperature or humidity.**

Available in 8 sizes—fractional to 10 hp. with ratios to 3 to 1.

Write today for illustrated catalog and complete technical data.

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4837 W. LAKE STREET • CHICAGO 44, ILLINOIS
ALSO MFRS. OF UNIVERSAL JOINTS AND FLEXIBLE COUPLINGS

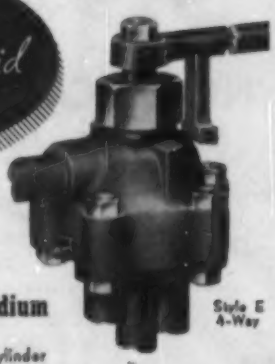
Post Scripts of Industry

Paul H. Taylor has been elected director and vice president in charge of the research and Hydra Spring divisions of the **Wales-Strippit Corp.** Taylor joined the company in 1945, and since that time has been director of patent and research.

Paul H. Taylor
Wales-Strippit Corp.

A new company has been incorporated for the manufacture of a new copper tubing fitting. It is

NICHOLSON
VALVES
for Air & Fluid Power



Style E 4-Way

Solenoid, Motor, Lever, Foot types for every medium

Nicholson furnishes valves for cylinder control, distributing, metering and for many special operating cycles. Installations in a wide range of plants have been in constant service for well over 25 years. In addition to their long wear and minimum maintenance, Nicholson valves feature: specially treated hard seats and lapping flat discs which actually become tighter with use; choice of 6 metal combinations to suit your specific service; positive protection against grit. Sizes, ¼" to 2½". Pressures up to 5000 lbs.

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TRAPS · VALVES · FLOATS
213 Oregon St., Wilkes-Barre, Pa.

UNBRAKO
dryseal-thread
PRESSURE PLUGS

seal tight
without compound

When UNBRAKO Pressure Plugs are tightened, major and minor diameters are positively sealed, pressure tight without sealing compound. UNBRAKO Dryseal-Thread Pressure Plugs, in a full range of sizes from ⅛" to 1¼" NPTF, are available from your local UNBRAKO distributor's stocks. Write for literature. STANDARD PRESSED STEEL CO., Jenkintown 2, Pa.

UNBRAKO SOCKET SCREW DIVISION
SPS
JENKINTOWN PENNSYLVANIA

Circle 87 on Reader Service Card

Circle 109 on Reader Service Card

known as **Tube Masters, Inc.** and is located in Charlotte, North Carolina.

Resistoflex Corp., Belleville, N.J. has announced that it has completed a licensing agreement with **Superflexit, Ltd.,** of England, under which the British company will manufacture and distribute Resistoflex's new "Fluoroflex-T" hose and hose assemblies. Under the agreement, Superflexit will have exclusive distribution of hose in the British Isles and all Dominions except Canada. It will handle non-exclusive distribution in western Europe as well.

At a recent meeting of the board of directors of **National Pneumatic Co., Inc.,** and **Holtzer-Cabot Divisions, Richard H. Frost** was elected director and executive vice president. Frost joined the company in 1947. Prior to his present position he was assistant to the president.

Richard H. Frost
National Pneumatic Co., Inc.

Charles J. McCarthy, aviation industry designer, has been elected chairman of the board of directors of **Chance Vought Aircraft, Inc.** McCarthy, recently a vice president of the United Aircraft Corp. and at one time general manager of the former Chance Vought Aircraft Division of UAC, resigned from United Aircraft. Recently Chance Vought Aircraft, Inc. became a completely independent manufacturer of aircraft and guided missiles, with an independent board of directors and no further legal or corporate connection with United Aircraft.

The appointment of **Clifford C. Brownfield,** as industrial sales engineer, was announced by **Roylyn, Inc.** He will make his headquarters at the Glendale offices and will service southern California industry.

Ted Affleck, president of **Valve Controls, Inc.,** recently sold his patents and manufacturing rights for his plug valve actuators to **Pantex Manufacturing Corp.** of Pawtucket, R.I. For some time he has been closely associated with the hydraulic division of Pantex in the designing and merchandising of their industrial hydraulic controls. He will continue to have an active interest in the engineering and merchandising of the product.

Seely Instrument Company, Inc. has announced the appointment of **Donald P. Geck,** The Chester Machine Company, 4205 Silsby Rd., Cleveland 18, Ohio, as manufacturer's representative in the state of Ohio.

HIGH PRESSURE PUMP

air driven... *for pressures to 30,000 psi*

Use for hydraulic presses and other hydraulic machines for clamping, riveting, crimping, shearing and punching. Applicable also for hydrostatic testing and other high-pressure, low-volume service.

• Boost 100 PSI. air pressure to 10,000 PSI. fluid pressure for $173.25 (FOB Gardena, Calif.). Eight standard models as listed in table. Special models for lower or higher pressures. Applicable wherever low-volume output at high pressures is the requirement. For oil or water service. Complete power packages also available. Send for bulletins.

Model No.	Maximum Input Air Pressure	Nominal Ratio	Discharge Pressure at 100 PSI. Input Air Pressure	Price, F.O.B. Gardena, Calif.
S-216-C- 10	150 PSI	10:1	1,100 PSI	$220.00
S-216-C- 20	150 PSI	20:1	2,100 PSI	210.00
S-216-C- 35	150 PSI	35:1	4,600 PSI	173.25
S-216-C- 60	150 PSI	60:1	6,600 PSI	173.25
S-216-C-100	150 PSI	100:1	8,800 PSI	173.25
S-216-C-150	150 PSI	150:1	15,200 PSI	174.50
S-216-C-200	150 PSI	200:1	23,750 PSI	225.00
S-216-C-300	100 PSI	300:1	33,500 PSI	299.50

SPRAGUE *Engineering and Sales Corp.*
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HAND HYDRAULIC PUMP

Single and Double Designs
to 20,000 PSI
With or Without Reservoir
Standard Reservoirs
70- 160- 910-Cu. In. Capacity
Interchangeable Pistons
⅜ - ½ - ¾ Inch
1-inch Piston (Special)
Pipe connections ¼" N.P.T.
Handle length is 18 inches.
"We specialize in hand pump units to operate in temperatures from minus 65 F to plus 160 F and with any capacity reservoirs required."
The single pump with ½" or ¾" piston now available in stainless steel.

WILLIAM S. PINE
1635 E. 22nd St., Los Angeles 11, Calif.

Post Scripts of Industry

William C. Denison, president of The Denison Engineering Company presents three scholarships to Edwin Fouse, Frederick Elder and Joe Couter.

Three Columbus, Ohio, high school graduates were named as winners of Denison Foundation Colleges Scholarships totalling $6000 by William C. Denison, foundation donor and president of The Denison Engineering Co. The boys are Joe Courter, Olentangy High School, Frederick Elder, West High School and Edwin Fouse, Grandview Heights High School. Each of the boys will receive $2000 to cover tuition and general expenses at any college in the country. The only stipulation made by the donor is that the winners take a course in hydraulic engineering. The boys were chosen from among outstanding high school students in the entire Columbus area after an intensive series of tests administered by a special testing board. The board was comprised of Glenn A. Rich, supervisor for the Ohio Department of Education, Richard J. Anderson of Battelle Memorial Institute and William E. Taylor, executive secretary of the Columbus Industrial Association. Announcing the winners, Denison said the scholarship award plan is designed "to foster interest in industrial hydraulics".

Circle 130 on Reader Service Card

Circle 90 on Reader Service Card

Kobe, Inc., newly organized by the founders of the original company of the same name has purchased the business and facilities of the Kobe Division of Dresser Equipment Company. General office and plant of the new company will remain in Huntington Park, Cal. Announcement was made by the president of the new company, **C. J. Coberly,** prominent in the oil industry as inventor of the hydraulic oil well pump, the Kobe Free Pump, the Kobe Triplex and other engineering innovations. Other officers of the company include, **C. James Coberly, Jr.,** vice president and general manager and **Harry C. Gunetti,** vice president of manufacturing. James Coberly was previously president of Surface Alloys, Inc., and Gunetti has been vice president of Joshua Hendy and most recently the manufacturing vice president of Locomotive Finished Materials Co. Under this reorganization, Surface Alloys, Inc. becomes a wholly owned subsidiary of the new Kobe, Inc. Coberly states that the new company will continue uninterrupted service with the same organization and facilities.

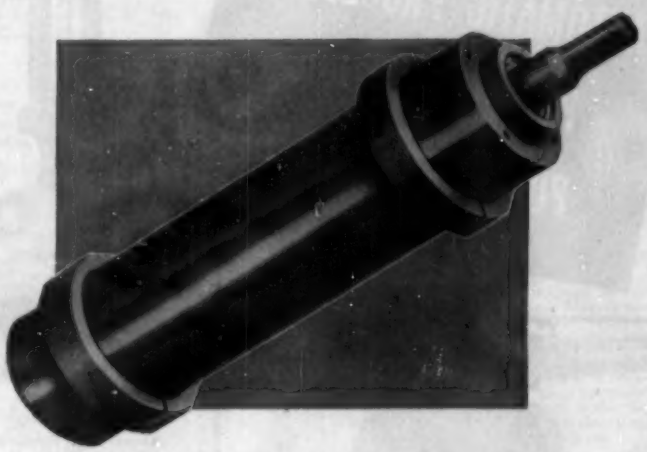
C. J. Coberly, left
James C. Coberly, center
Harry C. Gunetti, right
Kobe, Inc.

Harold E. Lewis
The Parker Appliance Co.

Harold E. Lewis has joined the sales staff of **The Parker Appliance Company** to head the hydraulics training program both in the field and at the main plant in Cleveland. He will report to Kenneth E. Jenkins, sales manager of the industrial hydraulics division and will be responsible for the development and administration of a complete training course in industrial hydraulics for district managers and sales engineers. **Scott A. Rogers, Jr.** is the new manager of the rubber products division, replacing **George A. Fort,** who moves to Los Angeles as quality control manager for all west coast divisions. **Donald S. Manning,** former production manager of the tube and hose fitting division has been promoted to manager of that division, succeeding **Walter C. Loeman,** who also moves to Parker

FOR LOW MAINTENANCE

Westinghouse Type "A" Pneumatic Cylinders



• Maintenance is no problem with these streamlined Westinghouse Type "A" Pneumatic Cylinders. They have only a few wearing parts, and *all* parts are strong and durable to assure long life in hard service. A wrench grip on the push rod makes servicing easy and adds to the life of the rod.

Westinghouse Cylinders are built with or without cushioning. They are light, compact and fast acting.

Standard construction is steel but for corrosive uses, brass bodies and stainless steel push rods can be supplied.

Diameters run from 1½" to 10" with strokes from 1" to 42"—and longer if push rod is in tension. Units can be foot-mounted, flange-mounted, or pivot-mounted.

Write for booklet 9308-2

Westinghouse Air Brake
COMPANY

INDUSTRIAL PRODUCTS DIVISION WILMERDING, PENNSYLVANIA

Pneumatic cylinders, valves, engineered pneumatic systems and air control devices of all kinds.

Factory Branch: Emeryville, Calif. Distributors throughout the United States . . . see your Classified Directory.
Distributed in Canada by: Canadian Westinghouse Co., Ltd., Hamilton, Ontario

Aircraft to assume managerial responsibilities there.

Three new distributors have been announced by **Morse Chain Company.** They are **Manufacturers Equipment and Supply Co.,** Flint, Mich.; **Schuman Steel Products Co.,** Bellingham, Wash. and **Jack Lee Machine and Supply Co.,** Attalla, Ala. All firms will handle the complete line of Morse products.

The Market Place

WILL BUY HYDRAULIC PRODUCT

Midwest manufacturer with young organization and capital over one million will purchase company having developed product with good potential in Hydraulics field. We are principals and will respect your confidence. Box 9154 APPLIED HYDRAULICS.

HYDRAULIC ENGINEER— HYDRAULIC SALES

Automotive parts Company wishing to enter Hydraulics Field requires top-notch Design Engineer capable of designing complete line of Hydraulic Cylinders and eventually other products. Must be thoroughly familiar with market requirements and able to design to meet top competition.

Also requires Sales Engineer intimately acquainted with Hydraulics Market and Distribution to establish and supervise sales outlets and general sales program. Must have drive, be able to plan, and have established connections in this field. Write Box 9254 APPLIED HYDRAULICS.

SELLING OPPORTUNITIES WANTED

New England firm, established 20 years, presently marketing aircraft quality products to industry, desires additional lines. Write to Box 9354, APPLIED HYDRAULICS.

WANTED: ENGINEER

for hydraulic sales in Eastern territory Expansion of our Hydraulic Division has created an opening in our sales staff for a qualified man. Prefer graduate mechanical engineer or equivalent with practical hydraulic or similar engineering experience. Sales experience desirable but not necessary. Salary and bonus. Car furnished. Send detailed resume to Oil Hydraulics Sales Division, Webster Electric Company, Racine, Wisconsin.

DISTRIBUTORS WANTED

All territories open. New program. Patented "Seal-Guard" Rod Wipers. Hottest item of its kind. Easy to order. Easy to stock. Easy to sell. Write Hydraulic Accessories Co., 24301 Hoover Road, Van Dyke (Detroit) Mich.

WANTED—SURPLUS ROD & BAR

Stainless—Aluminum—Steel—Brass
Any size; type and quantity. Cash for termination inventories.

Send lists to:

Collins Engineering Company
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WANTED
SURPLUS AIRCRAFT PARTS

or termination inventories
Get our cash offer by return mail.

Send lists to:

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9050 Washington Blvd., Culver City, Calif.

Equip your valves for

AUTOMATIC PROCESSING
REMOTE CONTROL
POWER OPERATION

(Above) High Pressure Gate Valve with Ledeen Valve Actuator.
(Left) Ledeen Tandem Type Valve Actuator on Standard Plug Valve.

with

Ledeen VALVE ACTUATORS

★ Simple, Rugged Construction.
★ Few Moving Parts.
★ Easily Installed.
★ Prompt Delivery.

These actuators are for the automatic operation of gate, diaphragm, plug and other line valves, and are pneumatically or hydraulically operated for direct or remote control. Designed as package units, they are mounted directly on the valves without need of special manifolds or outside supports. They are easily, quickly and rigidly installed on new valves or on valves in service.

Ledeen Valve Actuators provide positive operation, permit automatic processing, safety installations, multiple central control, and require a minimum of maintenance. WRITE FOR BULLETIN 3000.

VALVES • CYLINDERS
VALVE ACTUATORS
AIR HYDRAULIC
PUMPS & BOOSTERS

Ledeen Mfg. Co.
1610 S.O. SAN PEDRO STREET
LOS ANGELES 15, CALIFORNIA

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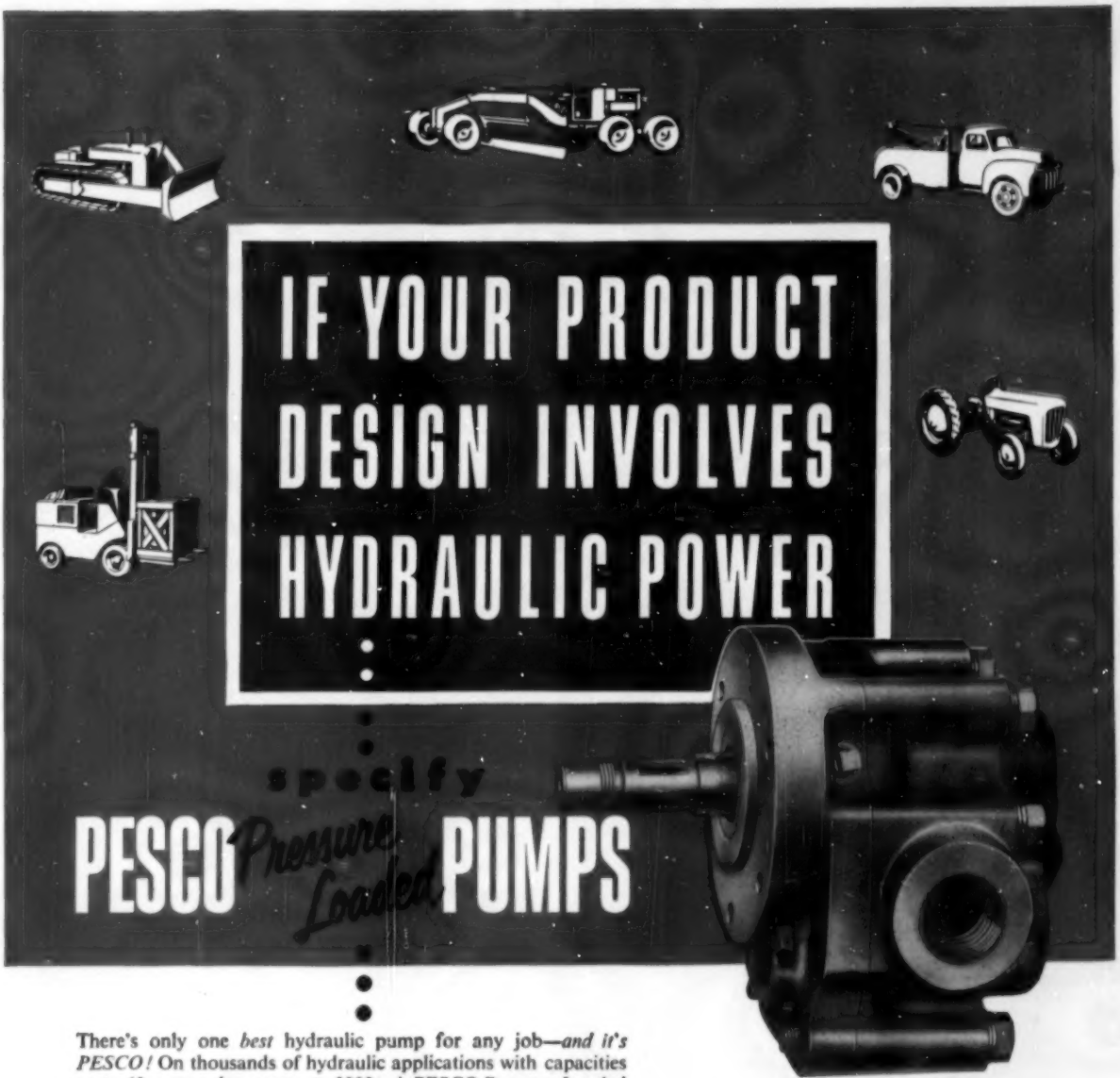

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FACTS

about the October NCIH issue of

APPLIED HYDRAULICS

The October issue of APPLIED HYDRAULICS will not only headline the activities of the Tenth Annual National Conference on Industrial Hydraulics, but it will carry full results of the 1954 Prize Paper Contest and a group of articles on training programs.

The issue will carry the complete program of the NCIH meeting, including chairmen and panel members of the various technical sessions. In addition, there will be abstracts of the papers to be delivered during the two day Conference.

The complete list of winners in this year's Prize Paper Contest will be announced. A special 16-page section will be devoted to the First Prize paper, two other Prize papers, a report on all winners of prizes and honorable mentions, photos and comments by the judges of the Contest.

Of special interest will be a group of three articles on hydraulic training programs. Two in-plant programs and the first engineering school program in oil hydraulics, that at the Illinois Institute of Technology, are featured.

Of course, our regular complement of articles on hydraulic and pneumatic applications will appear as usual. Outstanding articles include:

"Back Pressure—How it Affects Valve Operation"
By John J. Pippinger, Vice President, Double A Products Co.

"Safe Cut-Off Control"
By Wesley Grotewohl, The Ross Operating Valve Co.

"Oil Power Robot Does Work of Many Hands"
By Bruce Barton and Jack Grimes, Hautau Engineering Co.

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